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The Metropolitan West Side elevated electric railway, of Chicago, ran its first train on April 17. The main line is 1.8 miles long, extending from the station at Jackson and Canal Sts. to Paulina St. In addition, there are the Garfield Park line, 4.2 miles long; the Douglas Park line, 3.7 miles; the Logan Square line, 4.49 miles, and the Humboldt Park line, 2.13 miles long. On the various lines there are 43 stations, and the present equipment includes 55 motor cars and 100 trail cars. The cars are heated and lighted by electricity. The main line has four tracks. The General Superintendent of the company is W. E. Bader, and Mr. H. N. Brinckerhoff is the Electrical Engineer. The President of the company is Robert E. Jenks, and George Higginson is the Secretary. As this is the first American elevated railway to adopt electricity as a motive power, the results of its operation will be watched with much interest.

The Boston subway is now bid for by the West End Street Ry. Co., which controls and operates practically all the street railway lines of that city. Other parties are also said to be willing to take the enterprise off the city's hands. The West End Co. offers to provide for the payment of interest on the necessary bonds, and to be responsible for the creation and maintenance of a sinking fund which would wipe out the indebtedness at the end of 40 years. This would meet all the obligations imposed by the legislative act. The railways claim that they can afford to do this, because they can better develop their traffic in a subway; can maintain their line cheaper; avoid trouble from snow in winter, and can increase speed, as compared with their surface lines. This proposition seems to have effectually silenced the opposition to the subway, which has been based upon the claim that it might be a convenience, but would cost the city an enormous amount, for which it would receive practically no return.

The electric railway law of New Jersey is to be tested in the courts by the Central R. R. of New Jersey. The inciting cause was the commencement of the Somerville and Bound Brook link in the proposed New York & Philadelphia Traction Co.'s scheme. This link parallels the Central R. R., and work is now said to be stopped by virtue of a writ granted by Judge Magee until the constitutionality of the law can be tested under which the trolley company claims the right to build on the public highways. The Central R. R. officials base their action on the recent decisions of the Supreme Courts of Pennsylvania and Massachusetts, practically denying the right of county and township officials to devote the highways to the use of corporations for trolley lines. The trolley company, in this case, is a powerful one, and is said to be preparing for a hard fight.

The intramural railway at the Cotton States & International Exhibition, at Atlanta, Ga., will be built by Messrs Saportas & Wilkins, of New York, who have the concession for the line.

A speed of 76½ miles per hour, maintained over 58¾ miles of a run, was made on April 22 by the Pennsylvania R. R. line between Camden and Atlantic City. The actual running time was 45¾ minutes. Between Winslow and Absecon, 24.9 miles, the rate of speed was 83 miles per hour; and the fastest single mile was made in 41 seconds, or at the rate of 87.8 miles per hour. This is one of the most notable speed records yet made on an American railway.

The most serious railway accident of the week was a head collision April 20 at Fredericktown, O., on the Baltimore & Ohio R. R. A westbound freight train ran past the side track at which it should have passed an eastbound passenger train. Four men were injured, three probably fatally.

A hoisting apparatus in use for the construction of the steel steamer "Arcadia," at the South Chicago yards of the Chicago Shipbuilding Co., gave way April 19, and fell upon the deck of the steamer, where a gang of men was at work riveting the deck plates. Three men were killed, two fatally injured, and two slightly injured. The breaking of a guy rope was the primary cause of the accident.

Concerning the collapse of a business block at Syracuse, N. Y., reported in our issue of April 18, Mr. Henry C. Allen, City Engineer, writes us that no such accident occurred in that city. The item was taken from a press clipping.

In the preliminary trial of the new U. S. steel harbor defense ram "Katahdin," at Booth Bay, Me., a speed of 17 knots was maintained, and the builders believe she will make 18 knots on the official trial. The boat is designed to be exceedingly sensitive to her helm, and she turned within less than twice her length, says the report. The keel of the "Katahdin" was laid in 1891, at Bath, Me. She is 250 ft. 9 ins. long on the water line; 43 ft. 5 ins. beam; 15 ft. mean draft; 2,183 tons displacement. The engines are twin screw, vertical, triple expansion, with a maximum I. HP. of 4,800. The side armor is 6 ins., diminishing to 3 ins. at the ends; the conning tower has 18 ins. of armor, with 6 ins. on the smokestack and ventilators. The contract price of this ram was $930,000.

Five new torpedo-boat destroyers built for the British navy by Thornycroft & Co., of London, have developed very high speeds and are considered very satisfactory vessels. They are 201 ft. 6 ins. long, 19 ft. beam, and 13 ft. deep. Each has two triple expansion engines, with one high-pressure cylinder, 19 × 16 ins., one intermediate cylinder 27 × 16 ins., and two low-pressure cylinders, 27 × 16 ins. Steam is supplied by three Thornycroft water-tube boilers. The newest of these vessels, the "Ardent," has just had her trial trip, and on a 12-hour run of 156 nautical miles, or 13 knots per hour, with an average of 499.1 I. HP., showed a coal consumption of 1.53 lbs. per I. HP. per hour. This includes the steam steering engine and the evaporator for distilling water. The vessel had a draft of 7 ft. 4 ins. with 170 revolutions per minspeed was maintained with 170 revolutions per minute, or 786 per mile. Two of the three boilers were worked with natural draft, the working pressure being 180 lbs. The following table shows the results of the speed trials of the five vessels, being the means of six runs on the measured mile. The highest sped was attained by the "Boxer," which showed 29.175 knots per hour as the mean of a three-hours' run.

	Steam pres. lbs.	Revolutions- Port.	Starb.	Total I. HP.	Air pres. ins.	Speed, knots.
Daring	191.5	389	389	4,644	3	28.213
Decoy	191.0	366	365	4,009	3	27.641
Ardent	199.0	400	396	4,343	2¾	27.840
Boxer	201.0	410	415	4,487	2.6	29.080
Bruizer	204.0	...	...	.....	2	28.144

A revision of the international "rules of the road" at sea is demanded by Vice-Adm'ral Batsch, of the German navy, in a paper lately published. He particularly calls attention to the fact that to give the command "starboard" to the man at the wheel according to these rules really means that the bow of the ship is to turn to "port." This command had its origin at a time when tillers were used, and no longer applies to vessels above the size of a fishing boat. The French and German, and some other navies, have discarded this absurd use of the order; but it still is in use in the English and American navies, and on nearly all merchant ships. As employed on German and French naval vessels, the order now applies to the direction in which the ship is to turn, and not to the wheel.

Suez Canal traffic, for 1894, is thus reported by Consul-General F. C. Penfield, of Cairo: The number of vessels passing was 3,352, or 10 in excess of the previous year, and the amount received from tolls was $14,770,081. In 1874, 20 years ago, only 1,264 vessels used the canal. The year of largest business was 1891, when 4,206 steamers passed through. By reason of the application of electric light nearly 95% of the vessels using the canal in 1894 were enabled to steam at night. Only five American ships passed the canal, and these were warships and yachts. The British ships numbered 2,394, of 6,009,902 aggregate tonnage; Germany sent 294 ships through; France 184, and Holland 188. The aggregate net tonnage of all ships, in 1894, was 8,039,106 tons.

The contracts for the three seagoing torpedo boats has been awarded to the Columbia Iron Works, of Baltimore, Md., at $97,500 each. These boats will have a displacement of about 138 tons and a speed of 24 knots. The torpedo boats authorized by the last Congress will be larger and faster than these; plans are now being prepared for boats of 180 tons and 27-knot speed.

The proposed pneumatic conduit across the Brooklyn bridge, for carrying mail between the Brooklyn and New York post offices, is condemned in a report upon the project made by Mr. C. C. Martin, M. Am. Soc. C. E., Chief Engineer and Superintendent of the bridge. The proposed conduit was to be some 30 ins. in diameter, and the plans were drawn up by Mr. John F. O'Rourke, M. Am. Soc. C. E. The objection of Mr. Martin to their adoption is founded solely upon structural conditions. The conduit would require cutting into the masonry at the piers and anchorages, and into the brick arches on the approaches; or it would interfere seriously with floor beams if arranged on another proposed plan, and therefore cannot be permitted. This setback to the scheme is to be regretted, as the conduit would be of material service in facilitating mail transfers between the two cities.

Tank cars for the shipment of molasses and syrups are being used by C. W. Goyer & Co., of Memphis, Tenn. The cars are claimed to effect a large saving over the cost of handling the material in barrels, the advantages being similar to those which have been found in the handling of petroleum, cotton-seed oil and similar products. The tank has a capacity of 5,000 gallons, equivalent to a load of 60,000 lbs., and has steam pipes in the bottom to heat the molasses and make it run more freely. A pump is fitted by which the tank can be emptied in 15 minutes.

A State Board of Irrigation has been created in Nebraska by the legislature. The board consists of the governor, attorney-general, and commissioner of public lands and buildings. It appoints a secretary and assistant secretary, both of whom must be engineers, at salaries of $2,000 and $1,200 a year, respectively. The state is divided into two water districts, each of which is to have an under-secretary. The law contemplates active work in the interests of irrigation.

The adoption of the metric system of weights and measures in England was discussed at the 35th annual meeting of the Associated Chambers of Commerce of the Kingdom, held in London last month. The association approved of the expressed willingness of the government to appoint a select committee to ascertain what changes, if any, had become necessary in the British system of weights and measures. It was resolved that the executive council of the association should collect evidence with a view of placing the reasons for the desired reform forcibly before the proposed committee, and to support a bill for the amendment of the Weights and Measures Act. One object was the removal of doubt as to the legality of the use of metric standards for export trade purposes, and to provide for the verification and stamping of such exports by comparison with the Board of Trade metric standards. The association as a body favored the change, and thought it could be effected as easily in England as it was in Germany. The general sentiment of the chambers was that the object for which they had so long contended was now within a measurable distance of accomplishment.

The Transandine Railway is being pushed slowly at the Argentine end, and negotiations are in progress for raising funds to continue work at the Chilean end. The Argentine line has reached Punta de las Vacas, and the Chilean line ends at Salto del Saldado. The gap covers almost 50 miles, about equally divided between the two republics. It is, at present, traversed by stages, and the whole trip from Valparaiso to Buenos Ayres is now made in four days. The uncompleted portion includes some of the heaviest tunneling and gallery work. The railway was described and illustrated in our issue of Feb. 13, 1892.

A new water-works system, with the source of supply 4,000 ft. above the town, is to be built for Grand Junction, Colo. Water will be taken from the top of Grand Mesa. The plant will include some 24 miles of 10 to 20-in. wooden pipe, a 6,000,000-gallon reservoir, and about 10 miles of street mains. The estimated cost of the entire work is $200,000. Bids will be received about June 1. Mr. C. P. Allen, Chief Engineer of the Denver Union Water Co., is Consulting Engineer, and Mr. A. J. McCune, Engineer in Charge of Construction. We are indebted to Mr. Allen for this information.

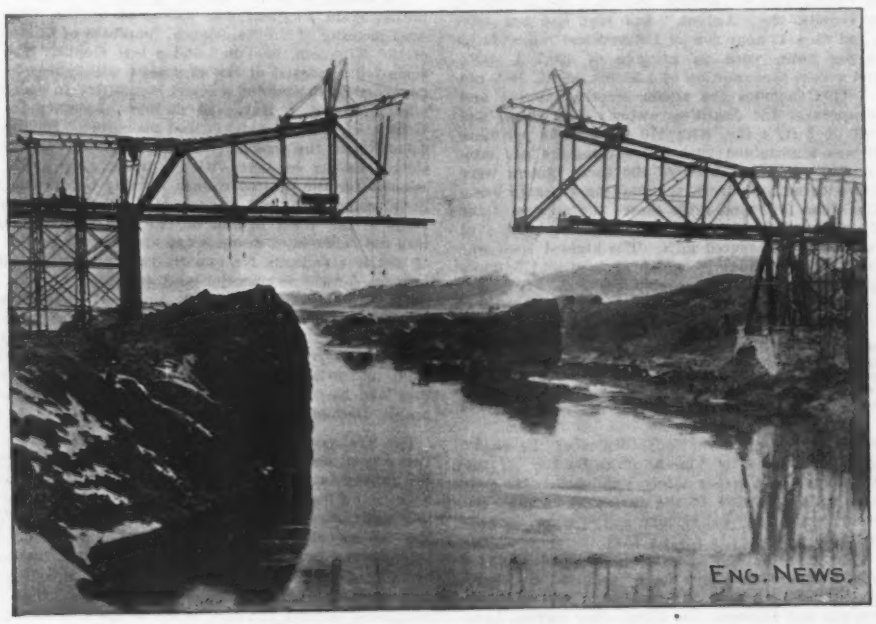
A geodetical survey of Africa is to be proposed to the forthcoming Geographical Congress by Lieut.-General E. F. Chapman. He suggests international action by the European countries now in possession, and points out the many advantages, economic as well as scientific, of extended geological surveys in the settled parts of Africa.

THE ERECTION OF BRIDGES.*

By Chas. H. Wright.

The erection department of a large bridge company is fast becoming one of its most important divisions. The increasing length and weight of bridges, the increasing price of lumber and the sharp competition, all render it necessary to give more attention to this branch of bridge engineering than has been done in the past. The conditions to be met are not precisely the same at any two locations, and to obtain the best results each case must receive special attention.

Girder Spans.—Short girder spans are often riveted up complete (including lateral and sway bracing) at the shops, and are unloaded from the cars directly into their final position on the masonry. This is done by means of derrick cars, by gin poles raised beside the track, or by sliding the girders on skids blocked up at one end to the level of the car; a snatch-block, fastened to the track a little distance back from the masonry, may be used to move the girders if they are too heavy to be handled without its use. Large and heavy girders are often run out onto the falsework on the cars, lowered down at the sides of the cars to the masonry, and then slid into position as the falsework is removed. Where the girders are too heavy to be shipped in one length, they must be unloaded near the bridge site and riveted up before they are taken out onto the falsework. As the facilities for handling the heavy pieces on the site are usually poor, and there is often very little room to work in, the splices should be so arranged as to allow the parts to be assembled with as little trouble as possible, and at the same time the amount of field riveting should be kept at a minimum. In through spans, where the floor is put in after the girders are in place, the connections should be so arranged that both beams and stringers can be swung into position. If it is necessary to spread the girders to allow the beams to enter, and to spread the beams to place the stringers, the erection will be slow and expensive.



ERECTING THE COLUMBIA RIVER BRIDGE.

If the plan proposed for the erection is known at the time the drawings are made, the arrangement of the connections can easily be made to suit. Drawings are sometimes seen which bear on their face evidence that the fact that the bridge had to be erected after its manufacture had never occurred to the draftsman.

Truss Spans.—In girder spans the question of falsework is not a very important one, as the bents are few in number and seldom very high. As the length of the span increases, so does the importance of the falsework. Where the water is not deep, and the falsework not very high, each bent is often bolted up complete on the shore, floated to place, and raised by means of a beam projecting from the last bent, and so on across the stream, each bent being raised by means of the preceding ones. Where the ground is uneven it is sometimes necessary to place the bent one stick at a time, and put in the bracing after the posts and stringers are in place. Where the bents rest on rock, or hard bottom, no sills are used. In moderately hard bottom a sill is used under the legs. By taking soundings this sill may be made to fit the bottom approximately. When the bents rest in soft mud it may be sufficient to use sills with short mud sills placed crosswise underneath, or it may be necessary to drive piles, which are cut off just above the water level and capped, the bent resting on the cap. The falsework is made wide enough so that two lines of rails may be laid, on which the traveler—arranged to clear the new span—can be run back and forth. If the floor is to be put in position first, the height of the falsework should be such that the beams will rest on it. If the trusses are to be put in place first, the falsework should be carried up to a little below the lower chord bars, and the bents so spaced as to allow the beams to be swung into position later.

The chord bars, diagonals, pins, etc., are first carried out and placed in position on the falsework; the panel points being raised from 2 ins. to 5 ins. by wedges. This arrangement shortens the diagonal distances and allows the bars to be more easily placed in position and the pins driven. The center panel is usually erected first; both trusses being raised at the same time. The center panel having diagonals in both directions, it is self-supporting. The chord splices should be arranged to give full pin holes in this panel. The center panel being raised and the lateral and sway bracing in place, the traveler is moved to the next panel toward the fixed end.

When the pins in the first panel were driven it was necessary to put the diagonals for the next panels in place on these pins. They were laid down on the falsework until the traveler had been moved to the next panel, when they were swung into position and held by lines, or, if they go inside the posts the tie-plates on the post would hold them up (the post being raised and held in place). The top chord had previously been raised a little above its final level, or high enough to allow the posts and diagonals to be swung in, and is now lowered into position and the pins driven. After all the panels have been raised to the fixed end, the traveler is run back and the other half of the span is raised, the end post at the roller end being the last piece of the truss raised.

To aid in driving the pins, tapered ends, called pilot nuts, are used. If the beams are suspended below the pins, the bents of falsework are so spaced as to allow the beams to be swung into place. Where the passage of trains cannot be interrupted the stringers are put in a panel at a time, and the track is only disturbed at this panel. There is generally time between trains to take out one panel of the floor, put in the stringers and replace the track

Deck Spans.—In erecting deck spans the falsework may be carried to the height of the top chord, or it may stop at the level of the bottom chord, depending on circumstances, as, for instance, whether the material is delivered at the ground at the level of the floor or beneath the bridge. In case the falsework stopped at the level of the lower chord, the erection would be carried on as in the case of the through span. The material would be raised to the top of the falsework and run out on push-cars and distributed in the same manner. When the falsework was carried to the full height of the truss, the traveler not having to clear the new bridge could be lowered, unless it was necessary to provide for the passage of trains. There would be a platform at the right height to receive the lower chord, and the eyebars, pins, etc., would be laid out on this platform as in the through span. It is necessary that the falsework be kept level and any settlement of the timbers is corrected by blocking up. Particular care is necessary with the first panel, as if this is not square and level there may be trouble in the erection of the truss all the way through.

Where it can be done, it is usually simpler to place the beams and stringers in position first. Often where the trusses are not set first there is trouble in spreading them to allow the beams to be slid into place; and where the posts and beams are set it may be difficult, or impossible, to get the stringers in without spreading them again. Entering connections at ends of stringers and beams can and should be avoided. The greatest trouble the erector encounters is caused by too little clearance between the different members at the joints. The shopwork, in spite of careful inspection, is apt to overrun a little, angles may be thicker than figured, the legs a little wider, and when there are several thicknesses of plates they will pack full, so that a figured clearance of ¼ in. may be actually no clearance at all.

In long and high spans the bents of falsework would be placed farther apart, to economize timber, and light wooden trusses used between them to carry the traveler and the new material.

Draw Spans.—The erection of draw spans, so far as the riveted work is concerned, is similar to that of fixed spans. That the machinery of a draw span should be properly set is almost as important as that the different parts should be properly made; and to secure the best results the machinery should be set by a regular machinist or by some one who has had experience in this work.

Viaducts.—Viaducts, including elevated roads, are usually erected by means of a traveler moving on top of the girders already erected, and overhanging far enough to reach the next bent ahead. This bent is raised by means of blocks and falls at the end of the traveler, and the girders are then raised by other lines and set in place on the columns. The bracing is then put in between the girders and the traveler is moved ahead to the next span.

Sometimes, where it is not necessary to keep the street clear below, the traveler is run on rails laid on the surface of the ground. More commonly, however, the first plan is used, the girders themselves furnishing the track for the traveler.

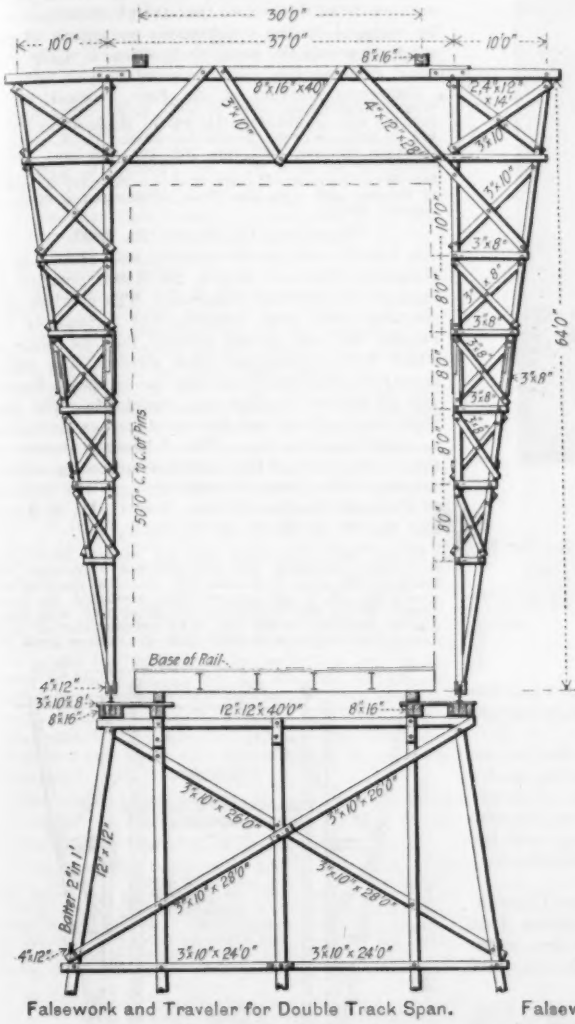
Roofs.—Roofs are much simpler of erection than bridges. There are no trains to be carried and no possibility of floods to be provided against. A pole a little higher than the roof and a set of blocks and falls are all that are used in raising light buildings. In longer spans the rafters would be raised by lines and poles at each end. The first rafter would be raised to place and held by guy lines until the second one was raised and the bracing between the two had been put in. If there are columns, they would be raised in the same manner. The men making the drawings should know in a general way the method it is proposed to use in erecting the work, and actual experience on erection is of great value to a draftsman.

* From "A Manual for Bridge Draftsmen," now in preparation. Copyright, 1895, by Chas. B. Wing, Professor of Structural Engineering, Leland Stanford University, and Chas. H. Wright, Edgemoor Bridge Works.

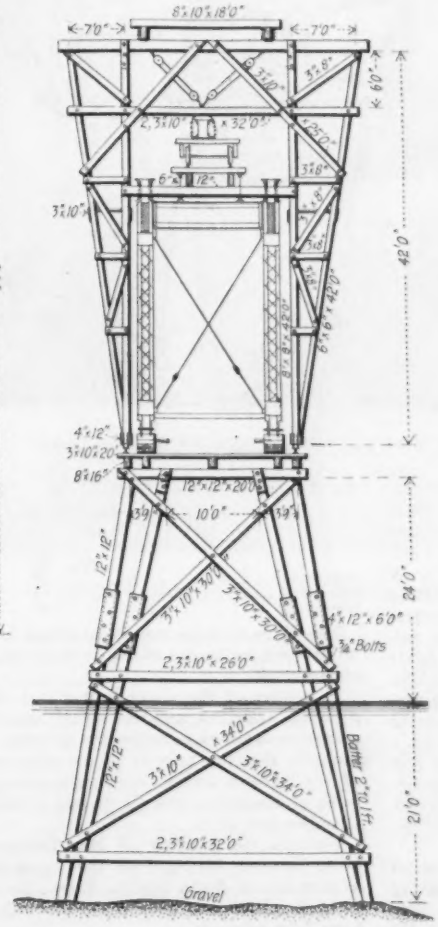
STAND-PIPE ACCIDENTS AND FAILURES.*

By Prof. Wm. D. Pence.

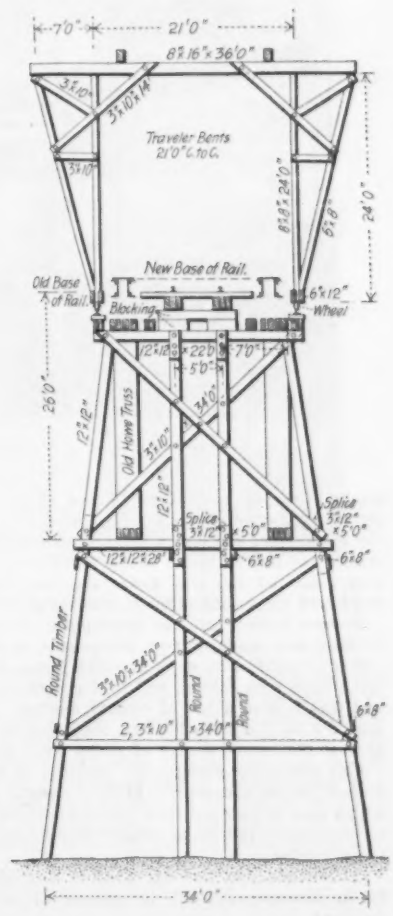
It is the purpose of this Appendix to give a supplementary record of stand-pipe accidents which were overlooked in the preparation of the original record or have occurred since the previous matter was put in type. In the progress of this later inquiry, as indeed was true of the former as well, several false rumors of stand-pipe accidents have been investigated, and by the co-operation of local authorities, confirmed where practicable through independent channels, such cases have been carefully excluded from these pages.



Falsework and Traveler for Double Track Span.



Falsework and Traveler for Single Track Deck Span.



Falsework and Traveler for Erecting a Deck Span Replacing Howe Truss.

Because of the limited number of cases here presented, no regular classification will be attempted. It is of much interest to notice that a classification of the cases here described along the lines followed in the original record would require a quite different set of headings in the matter of "cause." While several of these accidents resulted in little or no damage, they do not lack interest for that reason alone. In the discussion which concludes this Appendix, attention is drawn to the more important lessons to be learned from the supplementary record.

Chicago, Ill., 1854.

A brick tower, 136 ft. in height, enclosing a 2-ft. cast and wrought iron stand-pipe, which was built in connection with the water-works at Chicago, Ill., in 1854, was found to be leaning to the eastward, and the settlement continued until the top of the tower had left its original position about 14 ins. The plan of the tower was a hollow square, the outside dimensions being 14 ft., 13 ft. and 11 ft., at the bottom, middle and top, respectively, the reductions being made by exterior offsets. The stand-pipe was cast iron in its lower 100 ft. and was made of ¼ in. wrought iron in the upper 36 ft. The space between the pipe and the enclosing tower was utilized as a smoke channel.

The foundation of the tower consisted of masonry work resting upon a layer of sand 6 ft. below the surface, and the settlement above mentioned was found to be due to the unequal yielding of this stratum of sand. Adjoining the tower on the east side was the foundation of a pumping engine, established on piles spaced 3 ft. apart, the area covered being 32 × 42 ft., or 1,344 sq. ft. The engine foundation being on the side toward which the tower leaned, it was utilized in restoring the structure to its original position. A groove was cut into the foot of the brickwork on the east side and a double row of long wrought iron wedges was inserted, their butts resting upon the engine foundation. The east side of the tower was thus slightly lifted and close watch was kept upon the settlement as it continued on the opposite side. As required, the wedges were gradually removed until the settlement finally ceased altogether with the groove in the brickwork closed and the tower plumb. No damage resulted to the tower and it stood without further movement until in 1867-8 it was abandoned and removed.

References.—Andreas' History of Chicago, p. 188. Correspondence in 1894 with Mr. D. C. Cregier, of Chicago. Mr. Cregier was connected with the Public Works Department of the City of Chicago for an extended period, beginning in 1853, and is also the authority for the information concerning the above incident, found in the Manual of American Water-Works for 1888, p. 370, and for 1889-90, p. 438. The former is in error in giving the deviation of the top of the tower as 14 ft., while, as stated correctly in the latter reference, it was in reality 14 ins.

Erie, Pa., 1872.

A striking instance of the buoyant action of ice in a stand-pipe has been observed at Erie, Pa. The stand-pipe referred to is 5 ft. in diameter and when built in 1868 had a height of 220 ft. During the first year or so after its completion the stand-pipe was held in place by ⅝-in. guy rods, after which it was encased by a brick tower. The following description of the experience with ice, above referred to, has been obtained through the courtesy of Mr. Wm. W. Reed, M. Am. Soc. C. E., who was the first president of the Erie Water-Works:

In enclosing the stand-pipe we built the brickwork about a foot above the top of the pipe and floored it over. A railing was put on the outside, thus making a splendid view for those strong enough to ascend the 220 ft. of steps between the stand-pipe and the masonry enclosing it. As the pipe was entirely enclosed, we did not think it necessary to heat the space between the pipe and masonry in cold weather.

A few years after the works were put in operation we had a very cold winter, causing a cylinder of ice to form around the sides of the pipe, perhaps 8 or 10 ins. in thickness. When the weather grew warmer the ice loosened from the pipe and, rising by its buoyancy, knocked the platform off and sent a cylinder of ice 20 ft. or more above the top of the pipe. Within an hour of the time this happened two persons had been taking a view from the top of the stand-pipe. Had they been an hour later they would have met their death in a fall of 230 ft. After this we added 6 ft. to the pipe, letting it project above the platform, thus obviating danger of the kind above described. The present height of the stand-pipe is about 251 ft., extensions having been made from time to time.

It is obvious that the danger here described demands close consideration not only from those responsible for the safe use of stand-pipes, but also from the designer who may favor the practice of roofing them. It is, moreover, a fact which invites studious attention, that a brick casing with an intervening air space should have permitted the formation of ice to the extent above recorded. In seeking an explanation of this fact, it should be noticed that the conditions existing in the case under consideration seem to have been abnormal, not only as regards the small diameter and great height, but also in relation to the much-exposed site and the extreme severity of the season. The last-named element must have effected both a reduction in the temperature of the water pumped into the stand-pipe and also an increased rate of radiation of heat from the stored water.

References.—Correspondence with Mr. Wm. W. Reed, M. Am. Soc. C. E., Erie, Pa. (1894).

* Appendix to the series of articles on this subject concluded in Engineering News of June 7, 1894.

Wilmington, N. C., 1881.

A 20 × 70-ft. wrought iron stand-pipe, which was built in 1881, at Wilmington, N. C., had no metal bottom or anchorage. It appears that the stand-pipe was designed without engineering assistance of any kind, and that the bottom was left out to reduce the cost, the contractor claiming that it was unnecessary. Two unsuccessful attempts were made to secure a tight connection at the bottom: First, by means of a 12-in. bed of concrete inside the stand-pipe, and again by calking a joint in lead which was poured into a recess picked into the masonry, around the rim under the base angle. A third and successful attempt was made by putting a wooden bottom into the stand-pipe. This bottom or floor was made of two thicknesses of 3-in. yellow pine plank, laid so as to break joints, all joints being filled with oakum, and then coated with pitch, and was laid on a bed of cement mortar. To prevent the bottom from floating, short braces bearing against the second course of plates were inserted.

This seemingly unimportant incident is here presented as an illustration of the absurd practice which may be imposed upon well-intentioned parties through their failure to employ competent professional advice.

(This stand-pipe was extended to a height of 90 ft. in November, 1882, by means of a floating staging.)

References.—Engineering News, Vol. X., p. 153 (March 31, 1883); Vol. XXIX., p. 578 (June 22, 1893). Journal of the New England Water-Works Association, 1893, p. 68. Correspondence in 1894 with Mr. J. C. Chase, M. Am. Soc. C. E., Superintendent and Engineer Clarendon Water-Works Co., Wilmington, N. C. (who took charge of the works after the stand-pipe had been erected).

Holbrook, Mass., October, 1887.

In October, 1887, during a gale of wind, the 30 × 112-ft. wrought iron stand-pipe at Holbrook, Mass., was lifted repeatedly about three-fourths of an inch on the windward side, although no damage whatever resulted either to the tank or the foundation. The following facts relative to the incident are given by Mr. Freeman C. Coffin, M. Am. Soc. C. E., who was principal assistant to Mr. M. M. Tidd, M. Am. Soc. C. E., the Engineer of the Holbrook Water-Works:

Mr. Tidd had requested the commissioners to have some water pumped into the tank with a steamer (the stand-pipe having just been completed and connection with the mains not having yet been made), as he feared the wind; but they thought his fears unnecessary, and allowed it to remain empty. I was in Holbrook on the day of this high wind and visited the pipe to see the effect. I found that with each strong gust the pipe rocked upon the foundation and lifted on the windward side about ¾ in. I immediately got one of the commissioners to go there and see it, after which he hastily secured the town steamer and about 1,000 ft. of hose and pumped about 12 ft. depth of water into the tank from a small adjacent pond. This held the pipe firmly to the foundation until the pumping plant was completed.

I do not think that any wind that we have here would have blown it over, but I was afraid of the action on the foundation. I noticed no vibration of the sides. The top was thoroughly stiffened by an angle iron.

Mr. Coffin is unable to give an estimate of the velocity of the wind at the time, but the following record of maximum wind velocities, recorded at Blue Hill, about six miles from Holbrook, furnished by Mr. William Jackson, M. Am. Soc. C. E., City Engineer of Boston, from the New England Meteorological Report for 1887, may serve to throw some light upon the matter; corresponding figures for Boston, from the "U. S. Monthly Weather Review," are given in the second column:

	Maximum wind velocity, — miles per hour. —	
	Blue Hill.	Boston.
September	35	30
October	54	40
November	49	42

The three months are given owing to a possible uncertainty as to the exact date of the occurrence at Holbrook.

In neither of the above is it stated whether the recorded velocities are the actual maxima or the maximum average velocities for an hour. It seems probable that the velocity of the wind at the time of the incident under consideration was, upon the basis of the above records, in the neighborhood of 50 miles per hour.

Through the courtesy of Mr. Thomas Cunningham, General Manager of the Cunningham Iron Works Co., of South Boston, Mass., the firm which built the Holbrook stand-pipe, the following data have been secured:

The stand-pipe at Holbrook, Mass., is 30 ft. in diameter and 112 ft. in height. It was built in 1887, of refined iron of 50,000 lbs. T. S. The bottom is ⅞ in. thick, flanged to the shell. The thicknesses of the shell plates are as follows:

First	15 ft.	⅞ in. thick
Next	20 "	¾ " "
"	20 "	⅝ " "
"	20 "	½ " "
"	20 "	⅜ " "
"	17 "	¼ " "

The angle at the top is 3½ × 3½ × ⅝ in. The weight of the tank, including the rivets (5,000 lbs.), is 297,331 lbs.

While the Holbrook stand-pipe was not in the least injured by the slight lifting or rocking motion which it underwent, the incident seems to warrant the attention here given to it because of the possibility that the facts thus brought together may serve to throw some light upon the important question of wind action upon stand-pipes. Even though, as above stated, it was not at the time of the incident feared that the stand-pipe might actually be overturned, experience elsewhere has shown that the damage resulting from deficient or absent anchorage may not be confined to the foundation, but that the motion at the base, even when slight in amount, may greatly augment the vibrations of the thinner plates in the upper portion. The fact that no such damage resulted in the case under consideration would seem to be rather a compliment to the excellent quality of this particular structure than an approval of the practice of omitting anchorage upon the sole ground that the probability of the stand-pipe actually overturning may be somewhat remote.

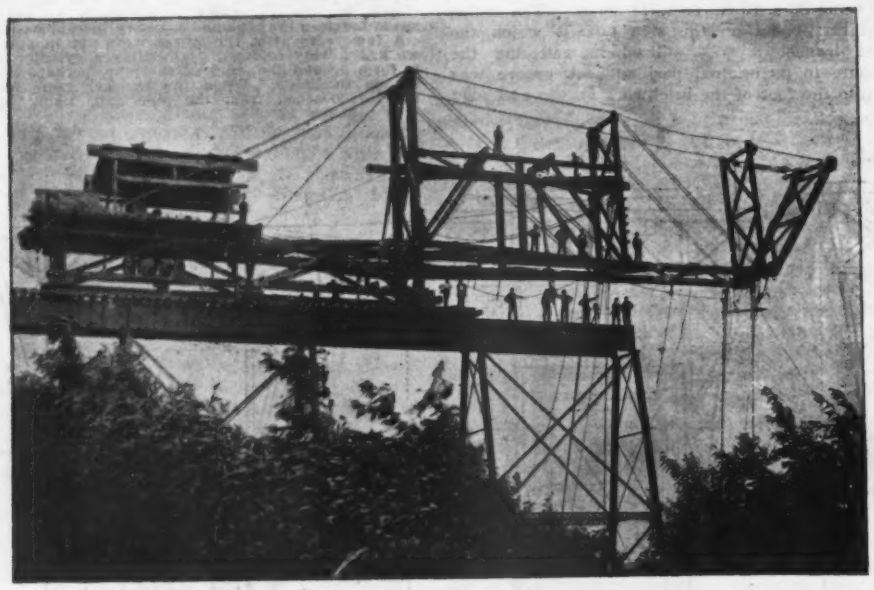
The above data relative to the dimensions and weight of the stand-pipe in question are of an unusually definite character, and the figures bearing upon the maximum velocity of the wind are probably as reliable as it may ordinarily be possible to secure. In recognition of this fact, further attention will be directed to the above data in the discussion which will conclude Appendix I. It is sufficient here to state that the recorded maximum velocities are in this, as in other cases, wholly insufficient to account for the lifting of the structure, and the conclusion already stated at several points in the body of this record that the phenomenon must be assigned to the synchronous pulsations of the wind storm and the metal shell, seems to apply with equal force in this case.

References.—Journal of the New England Water-Works Association, 1893, p. 204. Engineering Record, Vol. XXVII., p. 216 (Feb. 11, 1893). Engineering News, Vol. XXIX., p. 243 (March 16, 1893). U. S. Monthly Weather Review, 1887, pp. 262, 294 and 316. Correspondence (in 1894) with Mr. Freeman C. Coffin, and Mr. Wm. Jackson, M. Am. Soc. C. E., City Engineer of Boston, and with Mr. Thos. Cunningham, of South Boston, Mass.

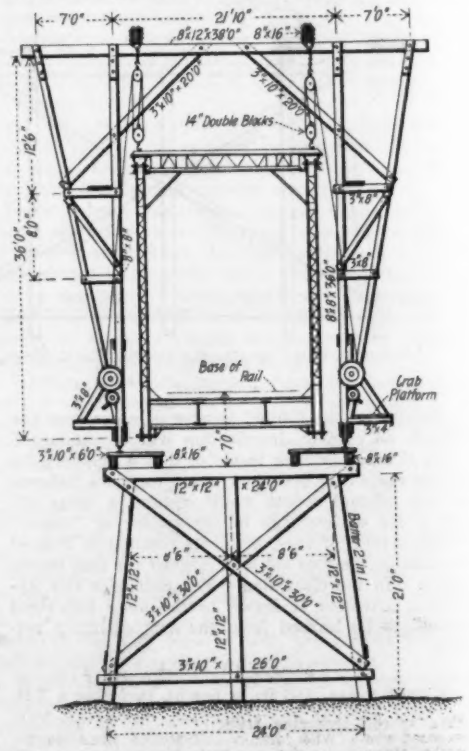
Hampton, Ia., March 26, 1893.

A fall of ice in the 10 × 110-ft. steel stand-pipe at Hampton, Ia., on March 26, 1893, resulted in damage of a striking character. The manhole connections were burst asunder, but fortunately the rupture did not extend beyond the one plate to which those connections were riveted. The water merely emptied itself through the orifice so formed and no further damage was sustained. The torn plate was replaced and the structure has since been in continuous service. The following account of the accident and of the conditions preceding and attending it has been obtained through the courtesy of Prof. A. Marston, M. Am. Soc. C. E., of Ames, and Mr. W. E. Hoxie, of Hampton, Ia.:

It had been extremely cold for several days. On the night preceding the accident the stand-pipe was pumped full, and it is believed that the mass of ice, consisting of a column or tube probably 40 ft. in height, which had formed in the stand-pipe, was frozen fast to the sides at the top. The consumption of water during the night was such that the water level was not more than 30 or 35 ft. above the base on the morning in question. March 26, the date of the accident, was clear and was marked by a considerable thaw. By 9 a. m. the influence of the solar heat upon the metal shell of the stand-pipe served to loosen the hold of the mass of ice above so that it fell. The damage was confined to the plate on the southwest side, which contained the manhole. The manhole connections were torn loose and the hole was enlarged, allowing the water to empty without further damage. The character of the fracture indicated that the steel plate was of excellent quality, the edges of the hole resembling those of a bullet hole in a sheet of tin plate.



ERECTION OF PANTHER CREEK VIADUCT, WILKESBARRE & EASTERN R. R.



Falsework and Traveler for Erecting Single Track Through Span.

The dangers to be feared from the action of ice within a stand-pipe are set forth with renewed emphasis by the accident above described. The most important observation bearing upon this case is found in the indisputable evidence which it presents in favor of plate-metal having high ductility, for had the plate been brittle in character there is little doubt that the structure would have failed totally.

References.—Correspondence (in 1895) with Prof. A. Marston, M. Am. Soc. C. E., of Ames, and with Mr. W. E. Hoxie, of Hampton, Ia.

Dodge City, Kan., July 1, 1893.

The 12 × 100-ft. wrought iron stand-pipe built in 1886, at Dodge City, Kan., failed during a violent windstorm at 7:55 p. m., July 1, 1893. The following information relating to the structure and its failure has been obtained from Prof. E. C. Murphy, of Lawrence, Kan.:

The foundation of the stand-pipe, consisting of sandstone masonry, is on a hill 130 ft. above the Arkansas River. The plates were of iron, ⅛* in. in thickness at the bottom and ⅛* in. at the top, horizontal joints being single riveted, the vertical joints double riveted; the rivets were ¾ in. in diameter. There were six ¾-in. iron guy rods attached to the pipe 75 ft. from the foundation, and connected to masses of masonry 90 ft. distant from the foundation. Two of these were at the northeast point, two at the southeast, one at the northwest and one at the southwest point. There were also in addition to these two wire guys added five years after erection, one at the northeast, the other at the southeast point. There were stiffening angles at both the top and bottom of the pipe.

The pipe leaned a little to the west, the two west guy rods being slack, while the four on the east side were taut. It was to correct or prevent further leaning that the two wire guys were added. The leaning was caused by the settling of the foundation on the west side. The opening for flushing, which was on the west side, leaked, saturating the ground on that side. It is not known when it began to leak. The pipe is said to have been full of water at the time it failed. The northwest guy rod broke 5 ft. from its anchor, at its union with the link; one of the northeast guy rods broke 20 ft. from its anchor at a link; the wire rope fastening at the top of the pipe failed.

The pipe failed in four places: (1) At the base, the first course tearing away from the bottom, leaving the latter in place; (2) between the 6th and 7th courses; (3) between the 11th and 12th courses; (4) a nearly vertical break between the 7th and 11th courses.

The pipe fell in a direction approximately south, the lower end now being at a distance of 12 ft. from the foundation.

The storm which led to the destruction of the stand-pipe is described as follows by the U. S. Meteorological Observer at Dodge City:

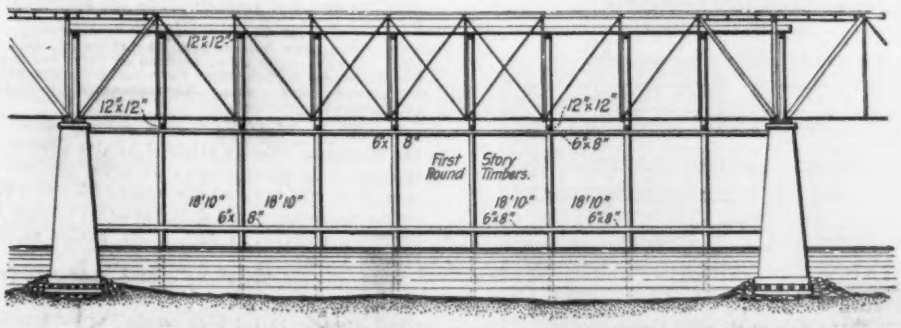
I observed the storm very closely. It came with great force in gusts from the north and northwest, but there was no whirl to it. The maximum velocity of the wind for five minutes was 54 miles per hour from the northwest. The extreme velocity (one mile in the shortest space of time) was 60 miles per hour. The maximum hourly velocity was only 30 miles. I think the wind blew much harder at the stand-pipe than at the observing station, because of the much exposed site of the former. Numerous chimneys and outbuildings about the city were blown down.

Unusual interest centers in the failure of the Dodge City stand-pipe, since it is the first total failure of a full tank here recorded in which the action of the wind was distinctly the cause. Careful consideration of the probable force exerted upon the cylinder by a 60-mile wind and of the weight of the full tank, even neglecting the additional stability afforded by the guys, gives no support whatever to the theory that the mass of water contained in the tank was actually lifted previous to the failure. In fact, the above-quoted statement by Professor Murphy, relative to the fracture about the base, and the undisturbed bottom indicates that the bedplate was held tightly in position by the hydrostatic pressure, supplemented by such adhesion as may have existed between the bottom of the tank and the mortar bed beneath it. It is, of course, certain that the guys attached to the north half of the stand-pipe must have given way before the metal shell could fall to the southward. This fact suggests the theory that the single northwest guy rod ruptured at a weld under the action of the violent gusts of wind, followed, perhaps, by the similar failure of a part or all three of the northeast guys; then, with the unbalanced guys acting at a point 75 ft. from the base, probably much augmented by their whip-like motion, and combined with the vibrations of the metal shell, rupture took place near the base on the windward side.

In the light of a careful analysis of the conditions above outlined, allowing for a reasonable multiplication of energy due to the concurrence of gusts and vibrations, it may be remarked that the strains thus accounted for are not great enough to explain the fracture of sound plate metal with fair riveted work. The conclusion is therefore reached that a flaw existed, probably in the row of riveting about the base angle on the windward side. It seems worthy of remark that the structure probably would not have failed had not the unbalanced pull of the guys increased quite materially the tensile stress in the metal on the windward side. Thus it is seen that guys provided for the purpose of ensuring stability in the stand-pipe may, by the failure of a portion of them, prove a source of danger to the structure. In another place in this record reference has been made to the wisdom of using more than four holding-down bolts when stand-pipes are anchored at the base. This observation, it is seen, applies with like force to the use of guys.

References.—U. S. Monthly Weather Review, 1893, p. 204. Engineering News, Vol. XXXII., p. 257 (Sept. 27, 1894). Correspondence with Prof. E. C. Murphy, of Lawrence, Kan., and with the U. S. Meteorological Observer, Dodge City, Kan. (1894).

ERECTION OF CHANNEL SPAN OF OHIO RIVER BRIDGE AT WHEELING, W. VA.



SIDE ELEVATION OF FALSEWORK FOR ERECTING DECK SPAN.

* Probably ⅝ or 5-16 in.

East Providence, R. I., Aug. 29, 1893.

As already stated in the original record, the then 40 × 120-ft. steel stand-pipe at East Providence, R. I., was lifted ¾ in. or more on its windward side during a gale which prevailed on Aug. 29, 1893, some nine days previous to the collapse of the upper portion of the stand-pipe. In connection with his description of the collapse of Sept. 7, Mr. J. J. Luther, Superintendent of the East Providence Fire District, thus refers to the earlier occurrence:

In the gale of Aug. 29, 1893, it blew hard enough to raise the pipe on the windward side some 4 or 5 ins. It would spring in and out and rattle like a sheet of zinc when shaken. We pumped it full of water the next day, the first water that had been in except to test the bottom, and it leaked the least trifle.

Mr. Geo. H. Leland, Assistant to the Chief Engineer of the East Providence Water-Works, describes the same occurrence in Engineering News of Jan. 25, 1894, in connection with an account of the final failure of the stand-pipe, which took place on Jan. 19, 1894, as follows:

On Aug. 29, 1893, a severe windstorm struck the stand-pipe, which was then completed to 120 ft., with the exception of two plates in the last or 24th course. During this storm the top swayed in and out like a large tree. The bottom on the windward side would lift from the foundation ⅛ to ¾ in. It was estimated that the wind at this time was blowing 60 miles per hour, but no harm was done to the stand-pipe at that time.

The estimate of the velocity of the wind above quoted is confirmed by copies of the record taken from the self-registering anemometer located at Providence, R. I., data from which have been obtained through the courtesy of Mr. J. Herbert Shedd, M. Am. Soc. C. E., City Engineer. Reference to the "U. S. Monthly Weather Review" shows that the storm of Aug. 29 was severe in character over a considerable area, as is shown by the following velocities:

New York city	54	miles	per	hour
New Haven, Conn	57	"	"	"
New London, Conn	57	"	"	"

An interesting and perhaps instructive observation may be reached by a comparison of the characteristics of the storm of Aug. 29, above described, with those of the storm of Sept. 7, which

resulted in the collapse of the upper portion of the stand-pipe. The following statement, relating to the storm of the latter date, was obtained through the courtesy of Mr. Samuel M. Gray, M. Am. Soc. C. E., Chief Engineer of the East Providence Water-Works:

The wind came in the form of a small cyclone, and only lasted 10 or 12 minutes, occurring about 7:50 p. m., when no one was present. In my opinion, it is quite probable that the stand-pipe did not lift from its base at this time, as the wind came on very suddenly.

Considering the difference in the nature of the two windstorms, that of Aug. 20 having been a gale, with frequent spurts of high velocity, but very short duration, while that of Sept. 7 was a "heavy blow," comparatively steady in force, followed by a single cyclonic burst of velocity lasting some ten minutes, there seems to be a sufficient explanation of the apparently anomalous occurrence of a lifting without collapse during the earlier storm, and a collapse without lifting during the latter. It is of interest in this connection to observe that with the two plates lacking in the 24th course on the earlier date, the ability to withstand a collapsing strain was doubtless less than on the latter when this deficiency had been supplied.

This reference to the East Providence stand-pipe for the third time in this record has been suggested by a similar incident at Holbrook, Mass., which has been described. Attention is again directed to the renewed discussion of the action of wind upon stand-pipes, which will be found at the conclusion of this Appendix. As will there be shown, and, as has been asserted in other and similar cases in these pages, the tilting of the East Providence stand-pipe may be accounted for only in the accumulation of energy by the concurrence of vibrations of the stand-pipe and gusts of the windstorm.

References.—Engineering News, Vol. XXX., pp. 205, 237 (Sept. 14, 21, 1893). Engineering Record, Vol. XXVIII., p. 298 (Oct. 7, 1893). U. S. Monthly Weather Review, 1893, pp. 239, 266. Engineering News, Vol. XXXI., p. 76 (Jan. 25, 1894). Engineering Record, Vol. XXIX., p. 135 (Jan. 27, 1894). Correspondence with the City Engineer, Providence, R. I., and with the Chief Engineer of the East Providence Water-Works (1894).

Holdrege, Neb., April, 1894.

The 15 × 110-ft. steel stand-pipe, built in 1888, at Holdrege, Neb., was observed to be leaning toward the south soon after its completion, and the inequality in settlement continued until the departure of the top from its original position reached 54 ins. It leaked badly from the time it was first filled, and although this evil was somewhat reduced by periodical calking, it was not entirely remedied until April, 1894, when the tank was emptied for the purpose of restoring it to a vertical position. The latter was accomplished by means of two T-rails bolted about the tank near its base, serving as a bearing for five jackscrews. It was found that the most serious leakage resulted from a crack, which originated in the base angle on the south side and extended some 16 ins. upward into the first course of plates, and also from the breakage of the threaded collar which was riveted to the bedplate, and into which the inlet main was screwed.

The foundation of the stand-pipe is of good quality, and consists of arched sandstone masonry, with a footing of concrete 3 ft. in thickness. It must have settled as a unit, since no cracks visible in the arch.

It is evident that the settlement was due to the saturation, and, perhaps, also to an inequality in the bearing power of the substratum. The break in the threaded collar seems to have resulted directly from the strains induced by the excessive settlement. That in the base angle and plate was apparently traceable to flexural strains induced in the angle by the deterioration of the cement bed under the bottom about the edges, the action of frost and thaw being greatest on the south side.

Considering the grievous condition of the Holdrege stand-pipe at the time when the repairs were undertaken, there is much cause for congratulation in the fact that its total failure has not been recorded.

References.—Engineering News, Vol. XXXI., p. 431 (May 24, 1894). Correspondence (in 1894) with Mr. M. D. Case, of Atlanta, and Mr. E. A. Howard (the contractor who repaired the stand-pipe), of Holdrege, Neb.

Billingsport, N. J., May 15, 1894.

About May 15, 1894, the floor timbers under one of two wooden tanks, which were supported upon a timber framework, at Germania Park, near Billingsport, N. J., gave way, the entire structure being wrecked. Each tank was 13 × 13 ft. They were placed one above the other, the elevation of the higher tank being 60 ft. The floor system under the tanks, consisting of 6 × 12-in. hemlock joists, is said to have been too weak, although it is not stated whether the deficiency was in the spacing or the quality of the timbers.

Reference.—Correspondence with the Germania Park Co., Billingsport, N. J. (1894).

Bayshore, N. Y., May 20, 1894.

On May 20, 1894, at about 5 p. m., the flanged connection of the supply pipe to the 20 × 150-ft. stand-pipe at Bayshore, L. I., cracked during a severe gale of wind. The following communication relative to the accident from Mr. E. R. Smith, of Islip, L. I., appeared in Engineering News of May 24, 1894:

The shank of the supply pipe cracked from the flange through the lower semi-circumference, at the end which is bolted to the stand-pipe, as shown in the accompanying sketch (Fig. 29). The stand-pipe was nearly full at the time of the accident, and the break was undoubtedly caused by the vibration of the stand-pipe, due to the high wind blowing a gale from the east, the supply pipe being at the opposite side. The stand-pipe was built in 1890.

The following additional facts have been obtained by personal communication from Mr. Smith:

The foundation of the stand-pipe is of grouted brick masonry, the depth of which is 3½ ft., the diameters being 20 and 23 ft. at the top and bottom, respectively. The foundation rests upon a stratum of sharp quartz sand containing a little gravel. This stratum extends to an indefinite depth, and it is regarded locally as practically incompressible, the slight settlement which does take place being as a rule perfectly uniform. The stand-pipe is located on low ground, and springs are encountered at a depth of about 2 ft.

The inlet pipe being on the W. S. W. side of the stand-pipe, is little affected by any slight movement which may take place under the action of the heaviest winds in that locality, they being most common in the northwest and southeast. The storm of May 20, 1894, from the east and northeast, was the heaviest known for years from that direction.

Rope guys had been secured to eyes located somewhat more than half-way up the sides of the stand-pipe, but they were never secured at their lower ends, and some months ago when the stand-pipe was painted they were taken down. No anchorage whatever at the base was provided.

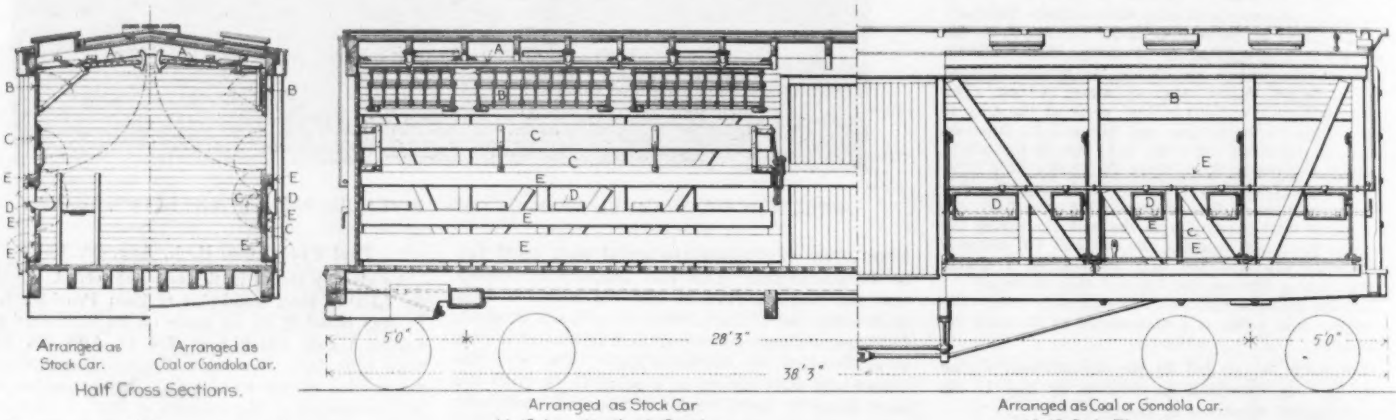


FIG. 1. DETAILS OF CONVERTIBLE CAR FOR FREIGHT, STOCK AND COAL SERVICE; BALTIMORE & OHIO R. R.

The U. S. Weather Bureau records show that the maximum velocity attained by the wind during the storm in question was 34 miles per hour at New York city between the hours of 5 and 6 p. m. on the above-mentioned date, the same velocity having been observed a few hours earlier at New Haven, Conn.

While the opinion above quoted, that "the break was undoubtedly caused by the vibration of the stand-pipe due to the high winds," is confirmed by a consideration of all attending circumstances, it is important to observe that the force required to stir bodily the "nearly full" 20 × 150-ft. tank (weighing not far from 3,000,000 lbs.) was far in excess of that which could have been exerted by a storm having a maximum velocity no greater than was recorded in that locality during the same storm; and, furthermore, the assertion just made is true even of the greatest wind pressures yet reliably recorded in any locality. Such being the case, it becomes necessary to seek an explanation through another channel.

It is stated that the lower elbow of the downward turn to the supply pipe was entirely clear of

the brick masonry of the foundation, so that whatever settlement had taken place during the period of about four years from the time of completion of the stand-pipe must have had the effect of developing in the rigidly-connected flanged castings a condition of flexural strain. The severity of these strains would depend upon both the rigidity of the connections and also the hardness of the stratum upon which the adjoining supply pipe rested, and they would seem to have been most severe at the point of fracture shown in Fig. 29.

Taking into account all known conditions, it would seem that because of the unusually gusty character of the gale in question, vibrations were set up in the less rigid upper portion of the nearly full stand-pipe, and that these vibrations, probably growing sharper and sharper under the concurrent action of a series of spurts of the storm, were transmitted through the thicker plates below to the rigidly connected and previously overstrained supply pipe. It is scarcely necessary to add that this theory is confirmed by the characteristic tendency of cast iron to fail suddenly under slight impact when suffering internal strain, and it also seems to be in full accord with the position and extent of the crack, as shown by Fig. 29.

The most striking lesson taught by the occurrence above described is the need of having such a degree of flexibility in connections of this class as

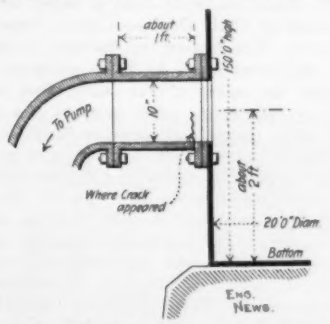


Fig. 29. Break in Supply Main to Stand Pipe at Bayshore, L. I.

to avoid strains of a severe kind under the action of vibrations or slight movements in the standpipe. It is stated by Mr. Smith that this need has been recognized, and that provision has been made for it by the use of a flexible connection in making the repairs.

References.—Engineering News, Vol. XXXI., p. 432 (May 24, 1894). Correspondence with Mr. E. R. Smith, of Islip, L. I., and with the chief of U. S. Weather Bureau, Washington, D. C. (1894).

(Concluded next week.)

A COMBINATION STOCK, COAL AND FREIGHT CAR.

The multiplication, during recent years, of freight cars designed especially for the carriage of certain classes of goods has had no small influence in increasing the perplexities of railway officers in charge of car movement. A scarcity of stock cars may be accompanied by a surplus of coal cars, for example; and, in general, the effect of this specialization of freight cars is to materially increase the number of cars necessary to handle the traffic and the mileage of empty cars.

We illustrate herewith a car adapted for use either as a stock car, a coal and coke car, or a freight and grain car. The car is the invention of Mr. R. B. Campbell, General Manager of the Baltimore & Ohio R.R., and Mr. F. E. House, Engineer of Maintenance of Way, of the same road, and it has been patented by them, while the details of construction have been worked out by the South Baltimore Car Works, of Baltimore, Md. These works have built the car shown in the cuts, and have an order for 10 of the cars for the Baltimore & Ohio R. R. and 5 for the Mather Stock Car Co. The mechanical construction of the car is such as to enable it to be readily converted for the carriage of any particular kind of freight, while attention has been paid to making the car strong and durable, and it is claimed that it will not be an expensive car to keep in repair.

The car is 36 ft. long inside, 38 ft. 3 ins. long over the end sills, 8 ft. 10 ins. wide over the side sills, 9 ft. 9½ ins. wide over the roof, and 10 ft. 10⅞ ins. high from the rail to the eaves of the roof. The weight of the present car is 35,900 lbs., but it is said that this can be reduced to about 33,-

Fig. 2. Interior of Convertible Car Arranged as a Stock Car.

000, while two Baltimore & Ohio R. R. standard trucks weigh 12,340 lbs. The present car has Fox steel trucks with 5 ft. wheelbase, the distance between truck centers being 28 ft. 3 ins.. The carrying capacity is 60,000 lbs., and though the present car could carry 70,000 lbs., it is intended to keep the loading to the rated capacity. The approximate cost, including royalty, would be about $600 per car.

The frames are trussed by four truss rods, the truss depth being considerable, and the struts being held firmly by tie rods through the lower ends to prevent twisting or spreading. The draft timbers are attached below the center sills in the common way, which arrangement, however, is inferior to that in which the draft-gear is between the sills, as in the Chicago, Burlington & Quincy R. R. cars, illustrated in our issues of Feb. 23 and March 9, 1893.

The changes are effected essentially by means of swinging partitions which can be placed in different positions, as shown in the cuts. When arranged as a stock car, Figs. 1 and 2, it is equipped with hay feed racks, having the necessary roof openings above, and has water troughs along each side, into which the water is run from tanks at the ends of the car, the tanks being placed at each corner of the car so that they can be filled from any position of the spout or hose on either side of the track. These troughs can also be used as grain feed boxes when the car is used for carrying horses, so that all provisions are made to comply with the laws respecting the transportation of live stock. To convert this stock car into a coal or coke gondola car, the troughs, D, are turned up on edge, and a portion of the slatted sides, C, C (exclusive of the door)

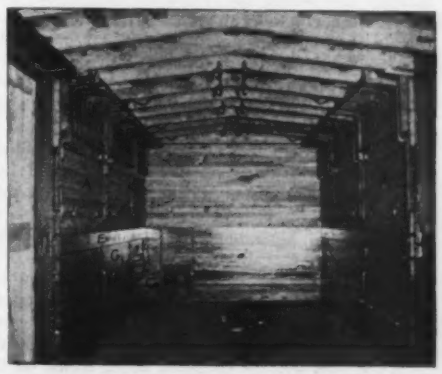


Fig. 3. Interior of Convertible Car Arranged as a Box Car.

is shifted from its upper to its lower position, Figs. 1 and 4, and tightly closes the spaces in the lower part of the side, E, E, so that the lower third of the side is tightly closed, and the middle third is open, so that coal can be loaded and unloaded more quickly and economically from this car than from an ordinary box car, of which the doors are the only openings. To convert this coal car into a box car, as shown in Figs. 1 and 3, the partitions A, which have been folded against the roof, are lowered so as to close the middle third of the sides, the upper third, B, being permanently fixed to the framing, and the bars of the hay racks closing against this upper part as shown in Fig. 3, which is also the position in the interior of Fig. 4.

The car is also specially adapted for the transportation of emigrants' property (for which service ordinary box cars are now used), as one end of the car can have the sides closed like a box car for the reception of the household goods, and the other end can be aranged as a stock car. In stormy weather, one side can be entirely closed and the other left open if desired. A large majority of the commodities now carried in box cars can be hauled in this car, and it can also be used for coarse grain by putting a batten on the floor. End doors are provided for the loading and unloading of rails, long timbers, lumber, etc., which cannot be loaded through the side doors. It will thus be seen that the car can be made available for any description of freight.

TEST OF A 5,000,000-GALLON TRIPLE EXPANSION PUMPING ENGINE, TAUNTON.

A vertical triple expansion pumping engine of only 5,000,000 gallons capacity, built to work under only 45 ft. head, forms a part of the new water supply of Taunton, Mass. This engine was tested on Oct. 12 and 13, 1894. The following description of the pump and test is from the last annual report of the Taunton Water Commissioners:

The engine is located at Assawampsett Pond and lifts water through a 24-in. cast iron main to Elder's Pond, from which the water passes by gravity to the Taunton pumping station, through about seven miles of 30-in. cast iron pipe.

The contract called for a duty of 120,000,000 ft.-lbs. for each 100 lbs. of best anthracite coal burned,

Fig. 4. Convertible Car Arranged as a Coal Car.

steam to be supplied at a pressure of 125 lbs. per sq. in. The test was for 24 hours, and was made by Mr. John H. Lewis for the Edw. P. Allis Co., and Mr. Geo. F. Chace, Superintendent of the Taunton water-works.

The engine has Reynolds-Corliss valve-gear, and the principal dimensions are, steam cylinders, 9, 16 and 23 ins., and water cylinders 18¼ ins in diameter, all of 18¼-in. stroke.

The average piston speed during the test was 192.2 ft., the contract guarantee being 175 ft. The average head of the discharge main was 32.58 ft., the suction lift of the center of the gage was 20.7 ft., and the suction friction 1 ft., making a dynamic head to be overcome of 54.28 ft.

Georges Creek Cumberland coal was used, which gave 2.88% of ash. The grate surface was 22½ ft., and the coal consumption per sq. ft. of grate surface per hour was 4.03 lbs. The water evaporated from and at 212° F. per lb. of coal was 10.52 lbs. The duty from 1,000 lbs. of steam was 131,706,389 ft.-lbs., and on the basis of coal consumed was 117,-327,000 ft.-lbs. The quantity of water pumped in 24 hours was 5,647,267 gallons, or 12.9% above the guarantee. The slip of water past the plungers is given as 0.016%.

As the above figures show, the engine attained a duty remarkably high, considering its small size, and would have shown a much better record still had not the boiler record been low, due probably to its very small size. The adoption of triple-expansion for an engine of only 5,000,000 gallons capacity is noteworthy, in view of the fact that it is hardly a half a dozen years since the first triple expansion pumping engines were built in this country.

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There has been a great deal of noise made recently in the Boston newspapers and the Massachusetts legislature by the opponents of the Boston subway. The enterprise is now so far advanced that an audacious move was the only hope if it was to be checked; so the opposition has used every endeavor to force a bill through the legislature requiring the resubmission to the voters of the appropriation for the enterprise. All the old arguments against tunnels and subways have been revived and made to do duty again, but the chief argument has been that the city had committed itself to a large expenditure, for which it would receive practically no return. There has really appeared to be little prospect of this faction gaining a majority of the legislature, although, after the action of that body on the Meigs railway scheme last winter, one would hardly feel like venturing much on prophecies of its action.

But whatever strength the opposition had gained, it has been effectually dissipated by the offer of the West End St. Ry. Co. to lease the subway on completion on terms which make it cost the city practically nothing but the loan of its credit. The suddenness with which the batteries of the subway's opponents were silenced was highly amusing; and there will probably be no further attempt to defeat the enterprise.

A report has recently been made to the stockholders of the Lake Erie & Western R. R., as explained more fully in another column, which is something of a novelty in this class of literature. It is, in brief, a complete statement, largely in tabular form, of the physical characteristics of the system, including practically its entire property except its rolling stock, tools and furniture. On general principles it is highly commendable for a railway company to present to its stockholders information concerning their property, and yet we are led to wonder how many of these stockholders will give this statement a careful examination, and what they would get out of such an examination.

There is no objection, of course, to publishing such facts as are given in this report; our only criticism is whether the labor and expense placed on this book might not have been better spent in giving the stockholders information of a different sort. It must be remembered that the great bulk of railway stocks are held by people who know nothing at all about the railway business. Great amounts of stock are held, of course, by speculators, who care nothing about what the permanent value of the stock is, and, in fact, prefer a stock which is worth little to-day and much to-morrow. Stockholders of this class and stockholders of the "bond-clipper" class, whose knowledge of business affairs is little or nothing, may be left out of the account. Whatever the character of a report may be, it is all one to them.

But among the stockholders of most large corporations more or less experienced and practical business men may be found. It is on them we must rely for securing honest and efficient administration of corporation affairs. We believe that this class of stockholders would welcome a class of information which few or no railway reports now contain. For example a statement of the amount expended during the year on contracts which were awarded without competitive bidding, coupled with a statement of the amount expended on contracts let, after public advertisement, to the lowest bidder, would be interesting reading. The total amount of free transportation in passenger miles furnished to different classes of persons and at the request of different company officials would make another statement deserving publicity. So we might continue; but it is not necessary. What the intelligent stockholder wants to know is whether the year's gross earnings were as large as possible, and whether the company's expenses were honestly and economically administered. There is no annual report which we have yet seen that contains this information in the detail which is desirable; and while it cannot be expected that stockholders will act as auditors, they might and would act to check serious leaks in the treasury and punish those responsible for them, if the detailed figures were placed before them.

Apropos of this, we may again mention a matter to which we have before alluded—the fact that private corporations do not, like municipal corporations, advertise their contracts and make bids and awards public. The opportunities which are thus open in many corporations for the securing of "commissions" by the responsible officers are too well known to need explanation or comment here. The first railway board of directors which will require the public advertisement of all contracts above a certain sum and their public award to the best bidder will do a great service to the cause of honest management of corporation affairs.

We are aware that the provision of many city charters requiring contracts to be awarded to the lowest bidder is often condemned roundly by engineers, who say that they desire to take into account the character of a contractor and his reputation for good work or bad. Unquestionably there is much that is pertinent in this view of the case. A contractor of little reputation will often bid for work at a price which leaves no margin for profit if thoroughly good work is to be done; and, undoubtedly, where such a man receives a contract, the engineer is apt to find his task no holiday one before the work is completed. But, on the other hand, an engineer should be very certain that he is perfectly sure of his ground before he takes the responsibility of recommending any other than the lowest bid for acceptance. The fact that a contractor has bid well below the engineer's estimate should not be allowed to weigh one particle against him. The call to bidders explicitly invites the lowest bids, and good business management often makes a profitable contract out of one where lack of system and intelligent direction would have made a loss at much higher prices.

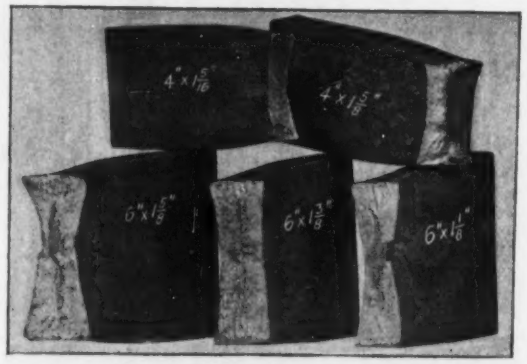
In the newspaper clippings which come to our desk we have found quite a number of instances within the past few months of the letting of work to others than the lowest bidders and the results have not been such as to throw much credit on the practice, so far as our information extends. In Chicago some time ago a sewer contract was awarded at $20,062, when seven or eight other bidders were lower, some of the prices being $17,262, $16,290, $15,792 and $13,433. The same firm is said to have taken another sewer contract at $7,973, when six other contractors presented bids running down to $4,668. Some twenty-five or more other cases are stated to have occurred, and the only excuse offered is that the city official who awarded the contract "wanted a well known and responsible firm to handle the work."

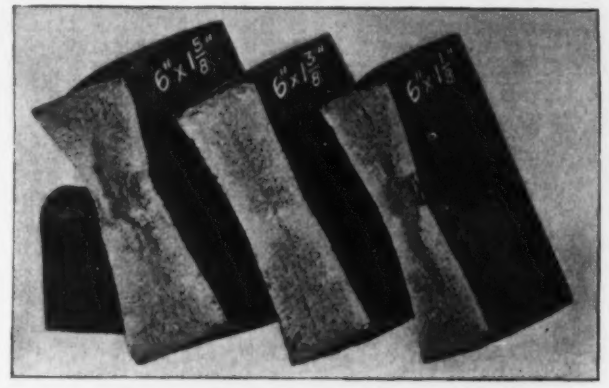
A case which has attracted still more general attention is the large sewer contract for the city of San Antonio, referred to in our issue of Nov. 22. The engineer for this work recommended the award to be made to the third bidder from the lowest, on the ground, we believe, that the two lower bidders could not do the work in accordance with the specifications at the prices they had offered without loss. The award was made, therefore, and the successful firm immediately relet the contract to a lower bidder at a clean profit, according to our best information, of some $50,000.

We allude to these specific instances merely to point the general lesson. It is sometimes said that an engineer should never award a contract without knowing that the contractor is responsible and of good reputation. But this rule should really be reversed, and an engineer should understand that an award to other than the lowest bidder is only to be made when weighty reasons can be given in defence of the course. Protection to the corporation's interest is the object of the specification, bond and contract, and it is here that reliance should be placed, and not on the contractor's reputation.

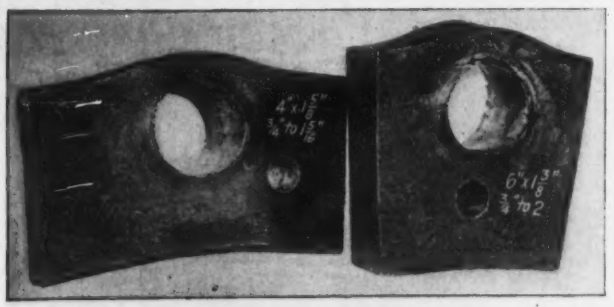
Mr. John I. Thornycroft, the famous builder of torpedo boats and other fast vessels, and Mr. Sydney W. Barnaby, lately read a paper before the Institution of Civil Engineers upon torpedo boat destroyers. The interesting feature of this paper is the statement made by these eminent authorities that the speed of the latest fast boats of this type approaches very near to the limit at which screw propulsion becomes inefficient. The first torpedo boat catchers or destroyers were built in England in 1885, and with a displacement of 65 tons maintained a speed of 19 knots. They were practically never used for the purpose intended, were converted into torpedo boats, and a new type was designed. The new class was represented by the "Rattlesnake," of 550 tons displacement and 19 knots speed. Then came the "Sharpshooter" class, of 735 tons, the "Speedy" class, of 810 tons, and the "Halcyon" class, of 1,070 tons, with speeds of from 19 to 20½ knots. But the speed of the torpedo boats was also being constantly increased, from 15 knots, in 1873, to 26 to 27 knots at the present time. This fact finally brought out the "Daring" type of torpedo boat destroyer, with a speed of from 26 to 29 knots. In this class the total weight was approximately equal to the weight of the machinery of the "Halcyon" class, but the indicated horse-power was 31 per cent. in excess of the "Halcyon." These boats, of which 42 have been ordered, have twin screws driven by two sets of four-cylinder engines, using steam at 210 lbs. pressure, and having a piston speed of over 1,000 ft. per minute. There are three water-tube boilers, with two furnaces. Considerable difficulty was experienced with the propellers first used. These had blades of elliptical form, with the minor axis 4-10 of the major axis of the ellipse. The slip reached as much as 30 per cent. at 24 knots, but blades of the same diameter and pitch, but with greatly increased blade-area, gave only 15.75 per cent. slip at 29¼ knots speed, with a corresponding reduction in indicated horse-power and number of revolutions for a given speed.

The conclusions arrived at by Messrs. Thornycroft and Barnaby may be summed up as follows: In boats of this class, with the screws working at a comparatively small depth beneath the water surface, the weight of water above the screws may be neglected, and the maximum thrust which could be obtained from the acceleration produced by atmospheric pressure close to the surface of the water may be taken at 15 lbs. to the sq. in. They estimated that the mean negative pressure per square inch of the projected blade-surface in the boat in question amounted to 8.5 lbs. as an average, with a greater pressure on portions of the blade, due to the fact that the thrust at the roots and around the edges of the blades was probably below the average. With this low pressure there was a tendency to form cavities behind the screw-blades, filled with air and vapor boiled off from the water; in other words, there was a lack of

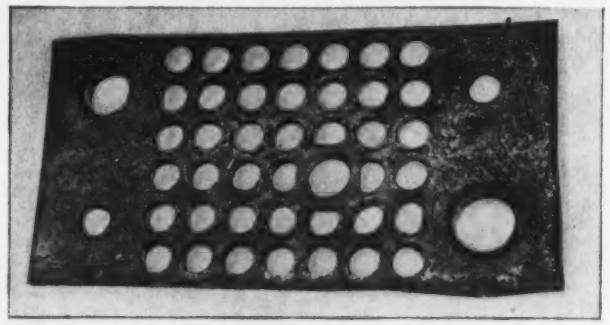




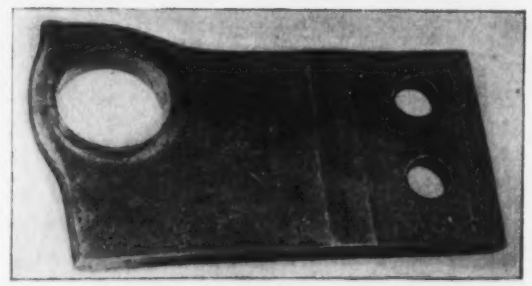
Fractures of Full Sized Soft Steel Eye-Bars Broken in Tensile Test.



Drifting Test on Full Sized Eye-Bar.



Drifting Test on 3-8 in. Plate, 13-16 in. Holes Punched 1 in. C. to C. End Holes Drifted to 1 1-8 ins. and 1 3-8 ins. Middle Hole Drifted to 2 5-16 ins.

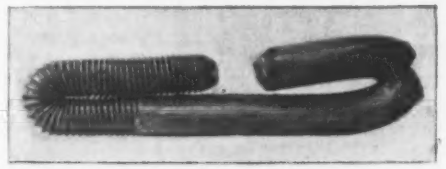


Angle 6X4X11-16 ins. Flattened Under Hammer and 15-16 in. Hole Drifted to 2 5-16 ins.

Double Bends in 3-8 in. Plate.

Bending Test of 51-lb. Channel

Knot of 3-4 in. Round and Disks Upset From 1 3-4 ins. Diam. and 3 1-4 ins. Long.



Rivet Stock, 7-8 in. Round Threaded and Bent at One End, Nicked and Bent at the Other.

Specimens of Soft Steel.

Tested by Harry J. Lewis, C. E.

solid water behind the screw supplying the resistance necessary for screw propulsion. For a given pitch ratio and slip, the thrust per unit of area varies as the square of the speed; and this "cavitation," as it is called, can only be avoided at very high speeds by increasing either the immersion or the blade area. But considerations of draft limit the immersion, and the increased blade area, beyond very narrow limits, can only be secured by a sacrifice of efficiency in the machine. As a result the authors declare their belief that, with 29 and a fraction knots, the speed of vessels of this type has now approached within a measurable distance of that at which propulsion by screws becomes inefficient.

The recent sudden jump in prices of crude oil appears, from all statistics available, to be likely to mark a permanent change, and one of no small moment from an engineering point of view. The production of oil has kept in advance of consumption for so many years through the constant opening of new fields that people have grown oblivious to the fact that an end must come to the supply of this valuable product, and that this end could not long be postponed if the world went on using up the supply at such a prodigal rate as it has been doing in the past dozen years. Prices of crude oil have gone lower and lower, however, notwithstanding the diminishing stocks, until finally the capitalists who control the oil industry have apparently realized that the producer must be given a larger compensation if the supply was to be kept up.

The advance in price has greatly stimulated the prospecting for new territory, and has caused the reopening of many abandoned wells of small production; but the total increase in production thus far secured seems to be small. An advance in the price of refined illuminating oil is probably inevitable, and in view of the very low prices now prevailing, and the fact that kerosene is by far cheaper as an illuminant than either gas or electric light, the advance will probably have to reach a considerable figure before consumption will be curtailed to a point at which increased production will meet it. Notwithstanding the increased price of crude oil, the use of oil for fuel does not seem likely to be materially interfered with for some time to come. The Ohio and Indiana oils, which now furnish a large proportion of the refined kerosene, leave a large residue on refining which must be disposed of in some manner; and if the price of fuel oil is raised any considerable amount, its use would be generally abandoned.

WATER SUPPLY OF NORTHEASTERN NEW JERSEY AND THE JERSEY CITY BIDS.

An examination of the excellent topographical maps of the New Jersey Geological Survey makes it evident that the streams which flow from the highlands in the northeastern part of the state are the ideal sources of water supply for the various cities lying on the west side of the Hudson, within a radius of a dozen miles from New York city, and including Hoboken, Passaic, Paterson, Newark, Jersey City, Montclair, the Oranges and numerous lesser municipalities, aggregating a total population of over 650,000.

It scarcely needed an engineer to suggest that these cities must eventually seek those pure mountain streams for their supply of potable water. Once suggested, the capitalist was by no means slow to grasp the idea in all its possibilities, the lawyer quickly discerned phases of the situation which appealed to him, the contractor and the manufacturer each saw a field for his exertions, and the politician was not blind to the golden opportunities presented. It is not strange, then, that the capitalist and his allies early began to develop plans to bring water and people together; nor that, as the needs of these municipalities became greater, the plans assumed corresponding proportions, until finally they included attempts to secure absolute control of all the available sources of water supply in the Passaic watershed. What obstacles were encountered, the measure of success finally attained, and the relation between these attempts and the water supply situation as it now exists in Jersey City, it is the purpose of this article to sketch in as brief a compass as the facts will permit.

For about a century the two dominating interests in the Passaic watershed have been the Society for the Establishing of Useful Manufactures and the Morris Canal & Banking Co. The former was incorporated in 1791 and has a right to the undiminished natural flow of the Passaic River over the Great Falls at Paterson comprising the run-off from 850 sq. miles of territory. These rights are the key to the whole water-supply situation, for below these falls the river is unfit for use, although Jersey City, under the pressure of necessity, still draws water from it.

The Canal Co. was chartered in 1824, and has rights to sufficient water to maintain navigation, for this purpose practically controlling the whole available water supply from Greenwood Lake and Lake Hopatcong, drawing largely upon the Rockaway River watershed and claiming rights in the Wynockie and Ramapo rivers. This property was leased in 1871 to the Lehigh Valley Railroad Co., which assumed fixed obligations amounting to some $200,000 a year. A desire to discontinue the use of this property for navigation purposes and devote it to other ends has been an important element in the history of New Jersey water-supply schemes. Without the co-operation of these two companies the success of any great scheme contemplating the control of the Passaic watershed would be impossible. As a matter of fact, the two corporations have played an important, if not a controlling, part in the water syndicate. The water rights on the Passaic River next above and just below Paterson, upon which are dependent the manufacturing interests of Little Falls and Passaic, were also brought into harmony with the above, these three water-power and the canal interests together representing many hundreds of thousands of dollars.*

The great struggle between the would-be water monopolists and the people began in 1881. At this time Jersey City, Newark and some smaller places were drinking Passaic River water, which was even then bad enough, though by no means so polluted as at the present time. Other municipalities west of the Hudson were, many of them, without public water supplies, and still others had supplies which would soon become insufficient. A bill was defeated in the New Jersey legislature of 1881, and passed in the session of 1882, only to be killed by the Governor's veto, which can be sufficiently described by quoting from the veto message as follows:

> This bill authorizes the formation of private corporations, which, upon the mere filing of a certificate setting forth certain general particulars, may proceed to acquire, by purchase, or by condemnation, under the State's right of eminent domain, all waters and watercourses not now in use for certain specified purposes. The object set forth is that such corporations may supply municipalities with water for domestic purposes.
>
> It is well known that a necessity now exists, and is constantly becoming more pressing, for some general system by which the rapidly growing cities and towns in the northern part of this state—to which the bill is more particularly intended to apply—may be enabled to provide for their inhabitants a proper supply of wholesome water. It would seem that they should have the first claim upon the natural public right in the waters of our streams.
>
> The right of eminent domain conferred upon those who may organize under this act is the right to take for public use the property of the private citizen.
>
> This bill is the reversal of that doctrine, and authorizes the condemnation of public rights for the benefit of private individuals.

It is said that this bill was pushed in the interests of the Society for Establishing Useful Manufactures. Its introducer has since been prominently connected with various water supply schemes.

The passage and veto of this bill so awakened the people most closely interested that sufficient pressure was brought to bear upon the very legislature which passed the bill to cause it to enact a measure of a directly opposite character—one which created a State Water Supply Commission.

About this time the syndicate which had done so much work to secure a monopoly of New Jersey's supply of potable water undertook a still more ambitious project—the furnishing of a supplementary water supply to New York city.

The need for more water in New York city, which finally resulted in the construction of the new Croton Aqueduct, was fruitful of many plans to supply the city from sources outside the Croton watershed. Among these sources the highland tributaries of the Passaic were looked on with some favor. One of the most important of these streams is the Ramapo. The upper watershed of this stream lies in New York state. In 1883 state legislation was secured in New York which made it possible for a corporation to divert 50,000,000 gallons per day of the water of the Ramapo before it enters New Jersey, convey it across the Hudson River and down to New York city. Objections to such a diversion were raised by the state of New Jersey, largely through the agency of its Water Commission, and nothing ever came of the scheme.

It need hardly be said that the water supply syndicate had taken the appointment of the water supply commission with a bad grace. In 1884 this commission made a report outlining a plan and giving estimates for a joint water supply from the Pequannock River to ten cities and towns, including Jersey City and Newark. The Commission looked forward to an extension of this system to supply other sections of northeastern New Jersey.

Thus, in the two years of its existence, the Commission was influential in defeating the introduction of Ramapo water into New York city, and was in a fair way to bring about the early construction of water-works for the very cities in New Jersey which the syndicate was planning to supply. To those familiar with New Jersey politics, it is not surprising that the work of the Commission about this time came to a sudden end. No attempt was made to repeal the statutes which brought the Commission into power, but appropriations were stopped, and one vacancy after another has remained unfilled until now three vacancies exist in a body of five members. Since 1890 or thereabout yearly attempts to secure legislation creating a State Water Board with ample powers to assume control of the water supply sources and build joint supply works have been defeated, largely by the private-water interests' influence.

In 1886 there appeared upon the scene a modest rival to the syndicate in the form of the North Jersey Water Co. This company offered to supply Jersey City from the Pequannock River, the source proposed by the State Commission, for $38.50 per 1,000,000 gallons. The syndicate promptly tendered water for $36. Neither company received the contract, whether because the people desired a supply under municipal contract as has been asserted, or because the syndicate only wished at this time to crowd out its competitor, we cannot state.

To obtain certain legal powers in securing water rights, it was necessary for the syndicate to secure a contract from some New Jersey municipality before it could proceed in its plans to the best advantage. On March 7, 1887, such a contract was secured with the township of Montclair, the Montclair Water Co. having been previously organized with a capital stock of $1,000,000. This was considered a mere entering wedge, as Montclair had then a population of only some 7,000 people. A temporary supply from wells was provided, but the contract mentioned a further gravity supply.

Turning again to the scheme of the syndicate to supply water to New York city, in 1887 and 1888 an immense amount of "promotion" was done in the furtherance of this plan. On Nov. 30, 1888, Mr. John R. Bartlett and associates made an offer to supply lower New York with 50,000,000 gallons of water daily, under a high gravity head, for $75 per 1,000,000 gallons. No stone had been left unturned to make the scheme as impressive

* On April 20, 1895, a prominent representative of the syndicate, speaking before the Jersey City authorities in behalf of the latest bid of the East Jersey Water Co. to supply that city, made the following statements, as reported in the Jersey City "Journal" of April 22: "The Newark contract has caused the East Jersey Co. hundreds of thousands of dollars in damages. We had either to condemn the rights of the Society of Useful Manufactures or buy it. We decided that the latter would be cheaper, and we paid $1,000,000 for the S. U. M. stock. Then we paid $800,000 for the Dundee Water Power Co. (which controlled the water power at Passaic—Ed.). We are to pay Beatty $525,000 for his riparian land and water rights at Little Falls."

The capitalization of the Canal Co. until 1890 was about $3,000,000, on which the lessees were bound to pay from 4 to 10%.

as possible. Accompanying the offer were the indorsements of scores of fire insurance men; three high army officials, a board of engineers, consisting of Messrs. Clemens Herschel, M. Am. Soc. C. E.; A. Fteley, M. Am. Soc. C. E., and Capt. T. W. Symonds, Corps of Engineers, U. S. A.; the Medical Society of the County of New York, and a dozen or more eminent New York and New Jersey lawyers. The various documents were printed as a quarto pamphlet of 100 pages, elaborately illustrated.

The supply was to be pumped from the Passaic River at Little Falls to a reservoir. The conduit was to pass beneath the Hudson River in the famous tunnel of that name, work upon which was renewed at this time by Mr. Bartlett. In addition to the signature of Mr. John R. Bartlett and associates, the proposition was approved by the following corporations: The Society for Establishing Useful Manufactures and the Lehigh Valley Railroad Co., the interests of which were described above; the Dundee Water Power & Land Co., of Passaic.; the Passaic Water Co., of Paterson, and the Aquackononk Water Co., of Passaic, both drawing water for public supply from the Passaic or its tributaries; the West Milford Water Storage Co., and the Montclair Water Co.

Regarding the rights of the Morris Canal, the following statement appears on p. 40 of Mr. Bartlett's quarto:

> The Legislature of the State of New Jersey, at its last session (in 1888—Ed.) authorized the company, or its lessees, to discontinue navigation and to sell the water and sources of water supply controlled by it. When navigation is discontinued the water used for that purpose and the large reservoirs mentioned can be applied to another and more important public purpose, viz.: the supply of cities and towns with pure and wholesome water.

But the best laid plans of the most influential promoters often miscarry. The boring of the Hudson River Tunnel was a necessary part of this plan, and Mr. Bartlett in his report declared that as a result of his investigations he had determined that the silt through which this tunnel is driven "is much safer in some respects for tunnel building than ordinary rock, for the reason that its composition is uniform and free from seams or fissures and the percolation of water. It will remain where it has been deposited a fixed mass for all eternity." Unfortunately for the Hudson Tunnel Co.'s stockholders, Mr. Bartlett's diagnosis of the material through which the tunnel is to pass did not conform with the facts, and although a million or two of dollars have been spent upon it since the time when Mr. Bartlett wrote, the tunnel still remains unfinished. The New York city authorities, moreover, looked with no very favorable eye upon Mr. Bartlett's proposal to sell them water at the high price named, and the whole scheme, so elaborately and carefully planned, came to naught.

Having failed in its attempts to secure contracts at Jersey City and New York, the syndicate next made proposals to Newark. An attempt was first made to sell Newark water from the sources supplying the Morris Canal; but though willing to give the syndicate a contract, Newark insisted that the supply must be from the Pequannock River.

On Sept. 24, 1889, the syndicate closed the contract by which it sold to Newark the supply from the Pequannock, which the North Jersey Water Co. had offered to Jersey City in 1886, the latter company selling its riparian rights to the contracting parties.

In the Newark contract, the Lehigh Valley Railroad Co. stands as the owner of all the water rights involved, and assignor of the same to the East Jersey Water Co., which was to construct the works. The city has the option of buying water by the million gallons or of purchasing the works, which were to have a daily capacity of 50,000,000 gallons,delivered partly at low and partly at high service. With a full consumption of 50,000,000 gallons daily, the price per million gallons would have been about $34. The city bought the works for $6,000,000, of which $2,000,000 is not payable until the year 1900. In consideration of this delayed payment, the company has the right to sell 22,500,000 gallons of this water daily anywhere outside the existing or future city limits of Newark, and outside the then limits of the townships of Belleville, South Orange, East Orange and Clinton, in which places, and no other, Newark may supply water. In addition, the Lehigh Valley Railroad Co. and the Morris Canal & Banking Co. also agreed never to sell water from any source within the above territory while Newark is making use of the Pequannock supply. Thus this highland stream in the Passaic watershed is wholly appropriated for use within the limits named after the year 1900.

The East Jersey Water Co., through the Montclair Water Co., is supplying a large part of the water used in Montclair and Bloomfield, and all that used in West Orange. Newark supplies Belleville, and in 1894 began to supply the village of Irvington, in Clinton township, but does not supply either East or South Orange.

In 1888 the Montclair Water Co. contracted to supply Bayonne by Sept. 1, 1890. Bayonne has for years been supplied by Jersey City, which it adjoins on the south. The company, it is presumed, hoped to supply Jersey City, as well as Newark, by the above date. Jersey City has not yet secured a new supply, and when the Newark contract was made, as detailed above, other interests seem to have dominated the syndicate, and another company was formed to carry out this work. Whatever the cause, Bayonne did not get water from the Jersey highlands, and recently contracted for a supply from wells on Staten Island.

From 1889 to 1892 the East Jersey Water Co. and allied interests were chiefly engaged in building the Newark supply system, which was put in operation in the latter year. As this work drew to a close, and Newark was getting ready to abandon the dangerous Passaic, interest in a pure water supply revived in Jersey City. Since the latter part of 1892 Jersey City has three times solicited bids, and three times, including its reported action this week, rejected the proposals submitted. Twice there have been one and once two formal proposals for a supply from the Rockaway watershed, in which source the syndicate is deeply interested; each time the syndicate has expressed its willingness to sell water pumped from the lower Passaic: the first time merely protesting because the specifications did not permit this; the second time putting in a bid, notwithstanding the fact that only a gravity supply was called for; the third time bidding under specifications for a pumping supply, but not complying with their terms.

Under all three calls no formal proposals were received for a supply outside these two sources, in which the syndicate is so deeply interested.

Under the call of Nov. 21, 1892, the first of the three, but one bid was put in. That bid was submitted by Moffett, Hodgkins & Clarke, of New York city, and offered a daily supply from the Rockaway of 50,000,000 gallons delivered at low service for $33.60 per 1,000,000 gallons, or $41.60 for water at high service. It was urged by the Jersey City Board of Trade and citizens in their private capacity that the specifications were designed to secure only one bid, and that from this source. The proposal was rejected in about six weeks.

In response to the second call, the above bid was practically renewed on May 1, 1893; Mr. H. J. Reilley also offered water from the Rockaway, setting his price at about $37; the syndicate tendered a supply from the Passaic River and tributaries above the Great Falls for $43. Acceptance of any of these bids was strongly opposed, and formal action was not taken for over a year, when, on May 23, 1894, they were all rejected.

The third and last formal call for proposals fixed March 25, 1895, as the date for receiving bids. Four elaborate sets of specifications were drawn up and proposals asked on as many different methods of supply*

As has been stated in previous issues, these specifications were so stringently drawn in some particulars, and were so ridiculous in others, that only few and high bids could be expected. The only two bids received were the oft-repeated alternatives of the Passaic by pumping or the Rockaway by gravity, submitted, respectively, by the East Jersey Water Co. for or as the syndicate, and the Jersey City Water Co. In the Rockaway watershed the syndicate claims control, both through its ownership of the Morris Canal and its purchases of land and water rights for city supply purposes. As has been pointed out above, it has secured legislative permission to abandon navigation on the canal and sell the water supplying it, and would have delivered this water to Newark, it is alleged, had not that city insisted on the Pequannock supply. But for three successive times the syndicate has not offered this source in response to requests for bids; instead it persistently continues to put forward the far less desirable Passaic, which is available only by pumping. It puts this forward with more or less informality each time, and at a high figure. The syndicate never offers the Rockaway in these three competitions, but it never has a formal competitor outside this source, and only once more than one rival, and then only two.

On April 23, the Street and Water Commissioners of Jersey City decided to send a communication to the two formal and four informal bidders under the last call, the first paragraph of which is as follows:*

> Inasmuch as this board by committee of the whole has deemed it advisable to reject the proposals for a new water supply as submitted to the board March 25, 1895, you are invited to submit a proposition to supply Jersey City with a supply of water by gravity into the high-service reservoirs at a head of 210 ft. above mean high tide.

The bids thus asked from these six concerns, on four days' notice, must be for a minimum daily supply of 50,000,000 gallons, delivered through one or two conduits, the city to have all the additional water in the watershed. In lieu of all water rates or rents the city will pay 5 per cent. interest on the agreed price of the works for 25 years, with the option of buying the works at the end of five years after completion, paying for the same either 25-year 4 per cent. bonds, or partly cash and partly bonds. The city will exercise its right of eminent domain for the contractor. The standard of purity named in the specifications of March 25, 1895, is to govern here. In regard to storage, this significant paragraph is inserted in the call:

> Storage reservoirs capable of 100 days' supply, at 50,000,000 gallons per day, must be provided within the state of New Jersey. In case any propositions are submitted taking water from Rockaway watershed, storage reservoirs, containing at least ten days' supply, at the rate of 50,000,000 gallons per day, must be provided in the Rockaway River itself, in addition to reservoirs north and independent of river and the Morris Canal.

As an alternative in the matter of cost, the contractor may name, practically, an upset price for land and water rights, and a price for construction. He may then choose between having the city condemn the above rights or buying them himself, privately. If he chooses to have the city condemn, then the price of condemnation shall be added to his bid for construction, and the total shall be the cost upon which the city shall pay interest, or which it shall pay for the works.

This new scheme shuts out the syndicate from renewing its old offer to pump from the Passaic and compels the other bidder, under the last call, the Jersey City Water Co., to modify its plans, and construct a reservoir on the Rockaway River, instead of drawing from that stream.

Shut out from bidding on the lower Passaic, and forced to make a high bid, if any, on the Rockaway supply, in order that it may abandon the Morris Canal, the syndicate is now in a position where it may be expected to oppose by all possible means the making or acceptance of any low bid from the Rockaway.

In view of the many complications in the situation it would not be surprising if there was still another change of plans on the part of the Jersey City authorities before many days, which would throw the award of a contract into the hands of the new Street and Water Board, which soon comes into power.

If the contract goes to outside interests, the great city water supply syndicate will have as its chief trophy the Newark contract, and out of the whole metropolitan area which it once proposed to supply it will be purveyor of water only to this one city and a few minor municipalities.

The city has taken a step in the right direction in

* See Eng. News, Jan. 24 and 31, Feb. 7 and March 7, 1895, for outline and discussion of these specifications; March 8 for proposals and April 18 for discussion of same.

* See postscript detailing probable change of plan.

giving bidders an opportunity to make practically separate proposals for construction and for land and water rights, the city to do the condemning, but the contractor to assume the cost above a certain point. But no contractor ought to be asked to assume such risks, if the city desires the best results at the least price. Moreover, if the contractor chooses, he may buy land and water rights privately, instead of having the city condemn, or, in other words, include in his bid a sufficient sum to satisfy the claims, speculative or otherwise, of any person in the proposed watershed, instead of allowing the city to have these valued by process of law.

If the contract for construction was entirely separate from the rest of the scheme, a score or more of wealthy and responsible contractors would be eager to bid for the work. If the city kept its right of condemnation entirely in its own hands it would seem to be greatly to its advantage.

Jersey City's vile water supply has been a by-word throughout this country for years. It has tried the same old plan for getting a new one long enough and could well afford to experiment a little with methods which are but common practice in other cities.

Postscript.

Just as we were going to press and since the above was written, it is reported that Mayor Wanser has insisted that proposals, as outlined above, must not be invited, on the ground that such action would be illegal; also that no consideration of the informal bids now in hand will be allowed. The action of the Committee of the Whole required formal ratification by the board on April 25. It may therefore retreat from its position, and again take the two bids of March 25 into consideration, if it so desires. If it rejects the bids formal proposals must again be asked, if Mayor Wanser has his way.

What the final outcome will be we will not attempt to predict, but this latest development only emphasizes the seeming helplessness of the Jersey City officials along the lines followed in the past and the necessity of an entire change of base.

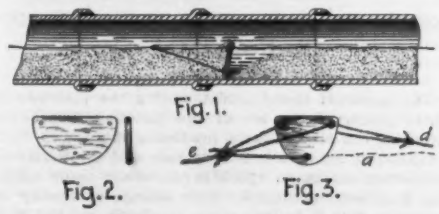
LETTERS TO THE EDITOR.

A NEW SAND SCRAPER FOR SEWER PIPES.

Sir: Having noticed from time to time in Engineering News illustrations of devices for removing sand from small pipe sewers, I take this opportunity to give to your readers the benefit of a scheme devised by me, and which I have found to be very efficient, and also very cheap.

Frequently, in the construction and maintenance of small pipe sewers, trouble is experienced in removing sand that may have, through accident or otherwise, become lodged therein. The writer had a case of this sort a short time ago, when the ground was frozen, so as to make even the work of uncovering manhole heads an expensive job.

A 12-in. water main, laid within 6 ft. of a small lateral sewer, burst, and not only destroyed the small sewer, but filled about 400 ft. of 12-in. sewer about two-thirds full of sand. To remove the same, I used the device illustrated herewith.



A Sand Scraper for Sewer Pipes.

Fig. 2 shows a plate of cast iron, which should be from ⅝ to ¾ in. thick, with rounded edges. The ropes should be attached so as to give the plate a little rake when drawn through the pipe, as shown in Fig. 1. After floating a small piece of cork attached to a light string from one manhole to the other, the small rope was drawn through, and with one man located at each end the work of removal was accomplished very rapidly, the scraper taking out about a 6-ft. section of the sand each time. I had some misgivings about the metal part being heavy enough to weigh the plate down to its cut, and at first had a small rope (a, Fig. 3) for the man at the upper manhole to draw the edge down with; but after a few trials this was found unnecessary. Truly yours,

William Nelson, City Engineer.

Laconia, N. H., April 12, 1895.

MEANING OF "ELASTIC LIMIT" IN STEEL SPECIFICATIONS.

Sir: I desire to protest against the statement made by Mr. A. C. Cunningham (p. 261 of your issue of April 18) in reference to the elastic limit, viz.: "When an engineer uses the term 'elastic limit' in a specification without qualification, it is generally meant and accepted that he means the scale beam elastic limit."

That in ordinary testing the elastic limit is approximately determined by the drop of the beam, honestly done, is one thing; but when unusual and questionable reports are made in reference to the elastic limit of a particular material, Mr. Webster is perfectly correct in asking for the real elastic limit determined in a proper manner, which is another thing. The scale-beam elastic limit can be made almost anything the manufacturer or inspector wishes, by changing the speed of the test.

It is well that engineers should know that when they specify an elastic limit of an unusual character they are obtaining only a high yield point produced by speeding up the machine. I have no objection to using the yield point in ordinary cases for comparative results upon the same machine, but when any engineer desires a high elastic limit, beyond the usual results, he is entitled to a correct determination of it. When manufacturers make higher claims than usual for their material, the proof must be made upon correct evidence. I fully believe the high elastic limits claimed in certain recent publications are false, and should have no credence until the results can be supported by evidence of correct tests.

Theodore Cooper, M. Am. Soc. C. E.

35 Broadway, New York, April 19, 1895.

AN EASY WAY TO REDUCE SQUARE FEET TO ACRES.

Sir: Noting in your issue of April 11, under the above heading, the exceedingly novel method proposed by your correspondent for reducing square feet to acres reminds me of an incident in my early professional life. I was then one of a large gathering of several parties in the state of Indiana, in 1835, under a United States assistant civil engineer, loaned by the U. S. Government to the state, for the purpose of inaugurating her projected system of internal improvements by the survey of certain railways.

This gentleman (now deceased) was an amiable embodiment of self-complacency, growing out of the effect of his unwarranted attachment as an assistant civil engineer to the then Topographical Corps of Engineers, whereby, through courtesy, he was frequently addressed as Captain, or even Colonel. This his weak mind could not bear without inflation, and his pomposity was curiously patronizing. He was in possession of a plethoric notebook of "receipts" (this was before the days of the Trautwines et al.), which it pleased him vastly to lend to the young aspirants for engineering honors, who, to ingratiate themselves in his favor, frequently asked the privilege of reading and copying from it.

I well remember two of the articles which struck me as highly valuable; one was "To convert cubic feet into perches (25 cu. ft.)." Instead of dividing by 25, if you multiply by .04 it will bring it into perches "beautifully." The other was: "Cairo, on the Mississippi River, is so many hundred and odd feet (the number forgotten) above the Gulf of Mexico—hence the Gulf stream." Never having seen these facts in print, I have treasured them in my memory, and take this method of preserving them for the benefit of the third generation thereafter. J. W. Adams.

Brooklyn, N. Y., April 13, 1895.

A PROBLEM IN VENTILATION.

Sir: Having recently had occasion to make calculations for a system of ventilation and being impressed with the apparent scarcity of information on the subject, I submit herewith a question in which some of your readers may be interested.

For a simple illustration of the point, let us suppose a main, A C, with a single branch at B, as shown in the sketch, A C being the direction of flow. Considering now the length B C, there will be a certain back pressure at B, due to the effect of friction throughout the length L, and the air passing B will be under a pressure due to this frictional resistance. The flow in the branch will be due solely to this pressure as long as the branch leads at right angles to the direction of flow in the main, and will not be dependent upon the velocity in the main itself, except in so far as the velocity affects friction, and, consequently, back pressure. If, however, we lead off at an "easy angle," say 45°, as directed in the catalogues of some manufacturers, we add to the flow just stated a certain amount due to a component of the velocity in the main, and in an extended system those branches nearest the blower, being first affected, will deliver more than their intended share, and this at the expense of those near the far end of the system. If, then, the above assumptions are correct, should not all branches be led off at right angles to the main, and would it not be possible to attain by this method more accurate results than by taking off the branches at easy angles and assuming the velocity in the branch to be the same as in the main at the point in question, which latter method, I have been led to believe, is the one most frequently employed? Many possible sources of information have been out of my reach, so that the question may have been treated in articles to which I have not had access; if so, references to those articles will be gratefully received. Yours respectfully, A. L. Hopkins.

Newport News, Va., April 1, 1895.

(Billing's "Ventilation and Heating" appears to be silent on this point in its text. The illustrations show branches from main air ducts both at right angles and at "easy angles." By properly proportioning the branches under either system it would seem possible to deliver the air in such quantities as might be desired at any points on the line. The "easy angles," of course, lessen the friction, a very important matter where large buildings are ventilated without the aid of blowers. —Ed.)

A PROPOSED METHOD OF INCREASING SPEED OF OCEAN STEAMERS.

Sir: The advance which has been made in the speed of ocean steamers has been by the use of enormous power, and seems, under the present conditions, to have about reached a limit, the well-named ocean greyhounds having passed far beyond the limit economically attainable for mercantile purposes. With the best frictional surfaces attainable, by far the greatest part of the power of the engines is absorbed by the friction between the water and hull of the ship. A material reduction of this skin friction would result in corresponding reduction of power, or gain in speed.

I have for several years believed this to be practicable, but having left ship-building, I have not been able to prove it experimentally; the idea may not be new, but in 40 years' acquaintance with marine work I have not heard it advanced. I therefore take this method of stating my views, where they may be confirmed or shown to be impracticable. I would interpose between the water and ship a film of air, constantly renewed forward, and passing out at the sides and stern, with the idea that from its levity it would adjust itself to a more or less uniform thickness, and reduce friction by the substitution of its contact for that of the water, to such an extent or percentage of surface as may be practicable.

The experiment may not be difficult or costly, for on a river or sound steamer, drawing, say, not more than 10 ft., and having a speed of 18 or 20 miles per hour, any amount of air desired could be carried under the hull on the principle of the Pitot's tube. On ocean steamers this would require to be supplemented by some air pressure. Any amount of power could be used; for an excess over actual need, as it would act as a series of propelling jets, would not be wholly lost; perhaps 200 to 400 HP. might be properly used on large steamers at full speed.

G. W. Pearsons, M. Am. Soc. C. E.

Kansas City, Kan., April 5, 1895.

(Doubtless, if a film of air could be interposed between the hull and the water, friction would be greatly reduced; but the crucial difficulty apparently would be at the outset. "First catch your 'are," as the old proverb has it. Air discharged in water generally forms bubbles of approximately spherical shape; and at the sides of the hull, which form a large part of the wetted surface, there would be practically no tendency for these bubbles to remain in contact with the vessel. Even on the bottom of the hull, it is a question whether the tendency would not be for the air to divide up in very small, nearly-spherical bubbles, each of which would have a very small area of contact with the hull in proportion to its volume. The problem, however, is one for experiment rather than theory to settle. A few simple tests of the action of air discharged on the underside of a board immersed in water, followed

by experiments with a flat-bottomed pleasure-boat with a hand pump for forcing air beneath it, should settle pretty conclusively whether there are any possibilities of practical value in our correspondent's suggestion.—Ed.)

VERTICAL OR INCLINED STIFFENERS FOR PLATE GIRDERS.

Sir: While the authors of "Modern Framed Structures" have presented a work which, from a practical standpoint, is far in advance of any other single treatise on the subject, there are one or two important practical points which are treated in rather a loose manner.

In Chap. VIII. Prof. Johnson discusses the stiffening of the web of the plate girder, and, by a peculiarly original system of disjointed logic, arrives at some highly interesting conclusions, directly at variance with the custom of practical bridge builders. In the commencement of his discussion he takes up a girder without stiffeners, and concludes that the internal web stresses are tensile and compressive, acting at an angle of about 45° with each other; which is probably nearly the case.

Next he apparently makes a flying jump to the conclusion that a girder having stiffener angles riveted to the web is exactly the same case and that the internal stresses in the web are distributed in the same manner both in intensity and direction. This conclusion is contrary to the fundamental principles of the distribution of stress so clearly stated by the Professor in Chap. XV., Proposition III., as follows:

> When there are two or more paths over which a load may travel to reach the support, the load divides itself among the several paths strictly in proportion to the rigidities of the paths.

Accepting the truth of this proposition, it remains to show that in a girder with vertical stiffeners the path of greatest rigidity is not that which he gives as the direction of the compressive stress.

Let us assume the web too thin to take the compressive stresses without stiffeners. The path of greatest rigidity would be a line diagram of a Pratt truss, in which the stiffeners would be the posts and the web plate would form the ties. And by Proposition III. the greater portion of the load would travel this way.

It should be specially noted that the web takes the place not only of the main ties of our Pratt, but also of the counters. In other words, it can take tension in either diagonal direction without a tendency to buckle. In case of a heavy live load covering less than half the girder, stiffeners inclined as Prof. Johnson advocates would be in tension near and at one side of the center, and there would then be a dangerous tendency for the web to buckle at those points, especially if the girder were deep.

Now, as regards the efficiency of inclined stiffeners, reasoning by analogy with the Warren and Pratt systems of web members, inclined stiffeners would be subject to greater compressive stress than vertical ones; added to this, they would be about 1½ times as long, making their weight probably about twice as great as necessary for equal strength with vertical stiffeners. Respectfully yours, C. A. P. Turner.

E. Berlin, Conn., April 2, 1895.

(A proof of the above letter was submitted to Professor Johnson, and we append his reply as follows:—Ed.)

Sir: In reply to Mr. Turner's somewhat severe strictures on my treatment of the shearing stresses in a plate girder, and the proper method of resisting the same, as given in Chapter VIII. of "Modern Framed Structures," I offer the following:

I. Since Mr. Turner does not deny the existence of the direct tensile and compressive stresses equal in intensity to the shearing stresses, and acting at 45° with those shearing stresses, we will assume that this fact is granted.

II. As to my "flying jump" to the conclusion that this is the condition of the stresses in the web of a plate girder, even after stiffener angles have been riveted to it, I will ask my critic if he will allow that, so far as there is any shearing stress in the web plate, at that point and to the same intensity, there are also direct tensile and compressive stresses acting at 45° with the horizontal, and at right angles to each other. If he will not allow that this is the fact, even after the stiffening angles are on, then his quarrel is not with me, but with the principles of mechanics. The controversy turns, therefore, on the question whether or not there is any great shearing stress in the plate after the stiffeners have been riveted to it. I think Mr. Turner will readily admit, especially when the stiffeners are put on in a vertical direction, that the web of the girder is subjected practically to the same shearing stress which had been developed in it previous to the adding of the stiffeners. In other words, if we should remove the web plate and substitute only the stiffening angles in a vertical direction, no one would allow that the shearing action of the external forces was properly resisted by the remaining members which now consist only of the upper and lower flanges and the vertical stiffeners. If these members do not carry the shear in the girder, certainly the web plate must carry it, and if this plate does carry the shear after the stiffening angles have been put on, then the shearing stress in this plate is the same as it was before the stiffening angles were put on, since these latter certainly do not carry any appreciable portion of the vertical shear. If, therefore, we have the same shearing stress in the plate after the stiffening angles are added that we had in the plate before these angles were added, then we certainly have the same direct tensile and compressive stresses, and to the same intensity, at 45° with the horizontal, and at right angles to each other, the same as we had before.

III. It may be proper now to inquire what purpose the stiffening angles serve, if they do not in any wise relieve the shearing stress in the web plate? My answer to this is, that their only purpose is to prevent this plate from buckling, and any external support which would prevent the plate from buckling into folds would serve exactly the same purpose. For instance, in the case of a flitched beam, where a steel plate is held between two wooden joists or beams, these latter serve mostly to prevent the lateral distortion of the plate. In other words, they prevent its buckling; but they ordinarily do not carry any large proportion of the bending or shearing stresses. The stiffening angles, therefore, are put on for this very same purpose, and they would serve this purpose just as well if they were clamped to the sides, and not riveted, or if they were held snugly against the sides of the plate by an external force, so as to prevent the lateral bending of the plate. In other words, the rivets in the stiffening angles serve only to hold these two angles together, and so hold the plate into a vertical plane. There is no vertical or lateral shear on these rivets, but tension only.

IV. One must distinguish carefully between the stiffening angles which are placed upon the web of the girder to prevent its buckling and the end angles which are placed upon the web at the ends of the girder for the purpose of distributing the vertical reaction or shear uniformly throughout this web plate. The stiffening angles must also be distinguished from such angles as are inserted under the point in the girder which receives a concentrated load at the top. These latter also serve to distribute such load or shear uniformly throughout the vertical depth of the web plate, and are not used for the purpose of preventing buckling primarily, although they, of course, do serve this secondary purpose as well, in common with the end angles.

V. It is important to remember that the primary stress in any beam is a shearing stress, and that all other stresses are logically derivative stresses. That is to say, the external forces are vertical forces, and the primary resistance or stress arising from these vertical forces, which are not coincident in position, is the vertical shear in the beam or girder. All other stresses or resistances are derivative from these shearing stresses. The shearing stress is, therefore, the original or primary stress, and other stresses cannot be developed except this primary stress exists. It is illogical, therefore, to assume the action of direct stresses, either in the web or in the flanges, without recognizing the existence of the shearing stress also.

VI. Referring now to Mr. Turner's use of my proposition III., in Chapter XV., that "when there are two or more paths over which a load may travel to reach the support, the load divides itself along the several paths strictly in proportion to the rigidities of the paths." I have used this as a fundamental principle which is almost axiomatic. I have found it a very helpful principle to use whenever there is more than one path over which an external force can be carried to the abutments. Applying this principle to the case in hand, I would reason as follows:

Since the primary resistance or stress is a shearing stress, the two paths over which this shear can be transmitted horizontally from the loaded point to the end supports are: First, the web plate itself; second, the framework composed of the flanges and vertical stiffeners. Just to the extent that this latter framework, when riveted together without the web plate, is able to carry the shearing stress from the loaded point to the end plates, to that extent it would share with the web plate the duty of transferring these loads horizontally to the end supports; but I think it is quite evident that the relative rigidities of these two paths, namely, the plate itself when prevented from buckling on the one hand, and the flange and stiffening angles along on the other hand, are such that practically all the shear would be carried by the web plate, and I believe Mr. Turner will readily grant that this is true. If this be granted, then there is little more to be said, since we will agree that the web plate carries practically all the shearing stress which comes upon the girder, and if so, the stresses in the web plate after the stiffening angles are added are practically the same that they were before these angles were added. The reason why a plate girder with vertical or inclined stiffeners does not act as a truss, as Mr. Turner has supposed, is simply because the web plate is so much more rigid than the surrounding framework, composed of the flanges and the stiffeners, that these latter are not able to carry any appreciable portion of the load, as follows of necessity from Proposition III., quoted above. Instead, therefore, of Proposition III. proving Mr. Turner's position, in my opinion it of itself is a sufficient proof of the falsity of his position.

VII. As to the advisability of adding the stiffeners in an inclined direction, I am still of the opinion that in the case of deep girders, where such an arrangement would not interfere with other connections, it is much the preferable disposition of these stiffeners, since, as I have said above, the purpose of these stiffeners is simply and solely to prevent the development of the lateral wave-like swellings or corrugations which form with axes in the direction of the tensile forces, and which could, in my opinion, be most effectually resisted or prevented by lateral supports at right angles to their axes, or, as we might say, directly across the waves, instead of at 45° with these axes, which is the case when the stiffeners are put on vertically.

VIII. As to inclined stiffeners being in the wrong direction for partial loads, I answer that stiffeners are only required at the ends, and may be omitted altogether near the middle of any plate girder. Where they are needed at all, the shear is never likely to be reversed, or, if it is, it would be very small, and the web plate alone would be abundantly able to carry it without stiffeners.

IX. I am very glad to have this opportunity of discussing in your columns at some length this problem of the stresses in the web of a plate girder. In my opinion this is one of the least understood of the many problems concerning the real distribution of stresses in the various portions and joints of iron and steel structures. My analysis of the proper splicing of the web of a plate girder, when this is supposed to carry a portion of the bending moment, as given in Chapter XIX., leads to a still greater innovation on present practice than my recommendation as to web stiffeners, which Mr. Turner has criticised. I believe, however, both these analyses very closely represent the exact facts, and both would lead to innovations in the present practice.

While the above analysis may be but another example of the writer's "peculiarly original system of disjointed logic," leading to a practice "entirely at variance with the custom of practical bridge builders," it is the best he has to offer, and he therefore begs the forbearance of more logically constructed minds. "Don't shoot the waiter, he's doing the best he can!" Respectfully yours,

J. B. Johnson.

Washington University, St. Louis, April 20, 1895.

NOTES AND QUERIES.

H. K. asks how much wind pressure (not only the amount per square foot, but the actual amount per lineal foot) was assumed for the Forth Bridge?

London "Engineering's" account of the Forth Bridge says:

> The wind pressure to be provided for in the calculations for bridges in exposed positions is 56 lbs. per sq. ft., according to the Board of Trade regulations, and this twice over the whole area of the girder surface exposed; the resistance to such pressure to be by dead weight in the structure alone.

We know of no published figures giving the wind pressure assumed per lineal foot of the span.

NOTES ON SOFT STEEL FOR BRIDGES.*

By Harry J. Lewis.

(With inset.)

The practical abandonment, during the past two or three years, of the use of the puddling furnace by some of the largest metal-producing firms, and their adoption of the open-hearth furnace and the Bessemer converter, marks an epoch in the metal trade which has long been predicted. This change is already so complete that it is impossible to obtain puddled iron of good quality and satisfactory pedigree, except for some special uses where it has held its own against the product of the furnace and converter. Shape rolls have also been adapted to the working of steel, and will hardly do satisfactory work in iron, even when the material is at hand.

Steel scrap has become so common that it is very difficult to exclude it entirely from the piles for muck bar, no matter how careful the mill management may be, and instances are not lacking where it has been

*A paper read before the Engineers' Society of Western Pennsylvania.

added deliberately for the purpose of raising the tensile strength of the so-called iron. While an apparently good weld can be made in some steel, it is equally true that it cannot be done at all times and in all steel, which fact puts the shadow of a serious doubt on all material whose quality depends upon the perfect welding of the motley collection of steel and iron which may at present find its way into a muck bar. Common sense would, therefore, seem to indicate that if we must use steel—and it now seems inevitable—we should take it as soon after it leaves the melting pot as possible, at the same time demanding such knowledge of the physical and chemical properties of each blow or melt as will insure both homogeneity and good quality.

These notes are not written for the benefit of those who must have special designs and special materials for the construction of engineering monuments which fail to pay interest on the investment, but for a more modest and happily more numerous class of engineers who are contented to submerge their ambitions and build from simple and well-tried standard designs with the best material to be obtained in the competition of the open market. This competition, together with intelligent specifications and inspection by the purchaser, is continually leading to the improvement of material, and during the past few years progress has been so rapid and has skipped from one method to another in such a way that standard specifications have in many cases been left behind in the actual execution of the work. The object in writing this is, therefore, to reflect as far as possible the present state of the steel-making industry as regards bridge material.

The first experiments in the use of steel in bridge work were mainly with material having an ultimate strength of 60,000 lbs. to 68,000 lbs., and in some cases from 70,000 lbs. to 80,000 lbs. Its irregularity in physical properties, together with the extra shop-work in the way of reaming rivet holes, etc., furnished a decided obstacle to its use in spans of moderate length, not only for the reason that the added cost of manufacture more than offset the saving in weight, but because conservative designers were slow to advance unit strains in proportion to the differences between the ultimate strength of this material and iron. For this reason, therefore, the use of medium and hard steels has been confined mainly to long spans, where the reduction of dead weight, consequent upon increased unit strains, effects almost double economy, and to eye-bars, which in annealing become practically a soft steel. On the contrary, in short spans (up to 250 or 300 ft.) there is no special desire to reduce dead weight unless attended by corresponding reduction in cost, as the dead weight is considered to be an element in the steadiness of the structure, and in these iron held its own for some time.

Of late, however, there has been a very decided movement in favor of soft steel, partly on account of the difficulty in obtaining iron, and which has resulted in the almost complete displacement of the latter material in bridge work. As might be supposed, the principal reason for this driving out of iron by steel is a purely commercial one, the fact being that the cost of iron made entirely from fresh-puddled stock is above that of steel which will stand much more severe physical tests.

The specifications appended below are suggested as covering most of the essential points of a good soft steel, and under practically the same requirements some very satisfactory material has already been obtained. It will be noted that they are somewhat brief, but experience has shown that short specifications are more likely to be lived up to, both by the inspectors and the mills, than long ones burdened with many comparatively unimportant details. At the same time, sufficient tests of different kinds should be required to place the quality of the material beyond any reasonable doubt, and that has been aimed at here. No new features have been introduced, however, as the mills are somewhat shy of accepting orders accompanied by specifications containing unusual requirements without making an advance in price which is very often entirely out of proportion to the advantage gained, and these specifications are intended to aid those who desire to obtain a good material at little or no advance from market rates.

The interest of the buyer and seller are in many things mutual as long as there is a disposition on both sides to play fair, and a good specification well lived up to benefits the honest manufacturer as well as his customer, the former being protected from the competition of shysters and the latter securing a uniformly good material. In this connection attention is also called to the fact that if a more uniform set of requirements were adopted the mills would find their work much simplified, and thus be able to cheapen their product. For instance, as at present, when the rolls are put in for a certain shape they may have to provide at least three different kinds of billets or blooms of soft, medium and hard steel, and roll extra pieces of each kind to provide for imperfections and rejections, much of which would be avoided by more uniform requirements, and the reduced amount of material thrown into stock would result in economy to the buyer. The stock itself would also become more valuable on account of its greater uniformity.

Specifications.

1. All steel shall be made by the open-hearth process. If made by the acid process it shall not contain more than 0.08% of phosphorus, and if made by the basic process the phosphorus shall not exceed 0.04%.

2. Two test pieces shall be furnished from the finished material of each melt, and in case more than one section is rolled from a melt, a single test piece shall be furnished from each. These test pieces shall have an area of cross-section not less than ½ sq. in., nor greater than 1 sq. in.

3. When the first two specimen tests fail to fill the requirements of the specifications, the whole melt shall be rejected and additional tests will not be allowed, except in case of obvious local defects in the original specimens.

4. Test pieces as above shall give results as per the following table:

Ultimate strength 54,000 lbs. to 62,000 lbs. per sq. in.
Elastic limit not less than one-half ultimate strength.
Elongation not less than 26% in 8 ins.
Reduction of area at fracture, 50%.

5. A copy of the analysis of each melt shall be furnished giving percentages of carbon, phosphorus, manganese and sulphur. The melt number shall be clearly stamped on each piece of material rolled, and failure to render all material easy of identification may furnish cause for rejection.

6. All fractures shall be fine, silky grey and entirely free from crystalline appearance.

7. Specimens shall bend double under the hammer, cold, without showing signs of cracking; and a punched hole ¾ in. in diameter and 1½ ins. from center to planed or rolled edge, must stand drifting to twice its original diameter without signs of cracking or failure either on the inside of the hole or edge of piece.

8. All finished material shall be free from cracks, blisters, scale or cinder spots, and have clean edges and good surface free from buckles or short bends.

9. Specimen tests of steel for eye-bars shall show an ultimate strength of 57,000 lbs. to 65,000 lbs. Elastic limit, one-half ultimate strength; elongation, 25% in 8 ins.; reduction, 45%. Full-sized tests of annealed eye-bars shall show an ultimate strength of 54,000 lbs. to 62,000 lbs. Elastic limit, one-half ultimate; elongation, 18% in 10 ft., including fracture; reduction, 45%.

10. All rivets in steel work shall be steel of the softest grade, capable of bending double and upsetting to one-third of original dimensions cold or hot, without the least sign of cracking.

The limitation to the open-hearth process has been and will be hotly contested by the makers of Bessemer stock, and a few of them can undoubtedly point to good results; but the fact remains, that while nearly all the makers of open hearth can turn out a fairly uniform quality of soft steel, only a small proportion of the soft Bessemer shows such uniform ductility, while in punching, hard and soft spots are often found to alternate each other at intervals of a few feet only. Including both the acid and basic processes, there are now enough works producing open-hearth steel to insure plenty of competition, with consequent low prices, and this specification has therefore been written to cover both, there being at present but little preference between them as to quality. A different phosphorus requirement is given for basic and acid steel for the reason that an amount of phosphorus in basic stock equal to that which acid stock might carry with safety, would indicate that something was radically wrong with the melt in which it occurred, and should alone furnish grounds for rejection. These remarks should not be construed as casting any reflection on the record which the Bessemer process has made for itself in the production of medium steel, to which grade it seems to be equally as well adapted as the open hearth.

The clause requiring two test pieces from each melt is intended to avoid delay for both mill and inspector in cases where a second test is found necessary, and the requirement covering a test piece for each section rolled from a melt, is for the purpose of developing any differences caused by heating or rolling. The range allowed in area of cross-section is sufficient to cover a wide range of sections, and at the same time is intended to exclude any large differences of physical characteristics depending on the flow of the material in the tensile test.

The ultimate strength has been placed at 54,000 to 62,000 lbs. so as to fully justify an increase of 10% over allowed unit strains for iron, and it is found in practice that a very small percentage of material falls below 55,000 lbs. Experience would indicate that it is not safe to use the medium strength of 58,000 lbs. in determining alowed unit strains, as the average of a day's tests will often fall as low as 56,500 to 57,000 lbs. The upper limit of 62,000 lbs. is also low enough, when taken in connection with the other requirements, to exclude any metal which would receive or retain temper or fail to close up, in rolling, any small imperfections in the ingot. Practice has also demonstrated that the 8,000 lbs. range allowed between upper and lower limit is ample, there being virtually no rejections on this score except such as are due to accident or carelessness in one or more of the four stages of production, viz.: the furnace charge; the melting; the heating of the ingot and reheating of billet, bloom or slab; and the rolling.

The elastic limit has been placed at one-half the ultimate strength, which is somewhat low, in order to remove as far as possible any incentive to cold rolling, and this has not been found to result in any lowering of the quality of the material. The different ways of obtaining the elastic limit in the various mills make this the most uncertain of all the observed properties of the material, and it is therefore hardly advisable to make the requirements regarding it too rigid, except in special cases, when the mode of taking the observation should be definitely prescribed.

The elongation has been fixed at 26% in 8 ins., as that figure seems to practically exclude all material showing the dry, dark, open-grained fracture so hard to describe, and yet so easy to recognize, and which is probably caused in most cases by improper heating. It has also been found that material showing the above elongation should pass the bending and drifting tests almost or quite invariably.

The reduction of area at fracture is placed at 50%, as the result of a considerable number of tests would indicate that this figure corresponds with moderate closeness to the minimum percentage of elongation above noted, where no apparent flaw exists at the point of fracture. The object has been to bring the two measures of the ductility of the material as nearly into harmony as possible. Some writers of specifications have omitted to require a record of the reduction of area, but in spite of the fact that it is only an approximation, the figures are so easy to obtain, and tell such a story as to the uniformity of the material that they should not be neglected.

A sliding scale has been adopted by some making the percentage of elongation equal 2,800,000, divided by the ultimate strength, and the reduction equal 1,500,000, divided by the ultimate strength, as in the accompanying table. This scheme has been rejected in writing the above specifications, as it is intended to secure a material equal to or superior to iron, and therefore a high degree of ductility is required at the upper as well as the lower limit of ultimate strength. It is desired to shut out in this way rejected melts of medium steel, which are too stiff to be classed as strictly soft steel.

No definite requirements have been made as to chemical composition except for phosphorus, as it is not desired to hamper the manufacturer further than necessary. It is considered advisable, however, to require a record of analyses showing percentages of carbon, phosphorus, manganese and sulphur, in order to determine whether each individual manufacturer is turning out a fairly uniform product.

While the character of the fracture alone could hardly be considered in itself as sufficient ground for rejection, a bad fracture should always cause a rigid investigation of the melt from which it is obtained.

The bending and drifting tests are required, as through them the high degree of ductility which it is desired to secure, under all classes of strains, is more fully assured. That they are not too severe has been amply demonstrated in practice.

The clause relating to material for soft steel eye-bars is not based on a sufficient number of tests to justify its unqualified recommendation. Such work as has been done, however, would indicate that soft basic steel suffers a greater reduction of ultimate strength between test specimens and annealed full-size member than medium steel; the observed differences averaging about 6,000 lbs., as against 4,000 for the latter. If further observations show this to be a constant characteristic, it may be found advisable to increase the range between the upper limit of ultimate strength in the specimen test and the minimum limit of the annealed full-sized test in which case it would probably be better to lower the latter requirement to 52,000 lbs. than to increase the former. In the absence of sufficient data from soft steel eye-bars, this inference has been drawn from the experience of railroad boiler makers, who have found 65,000 lbs. to be about the right upper limit for material which is to be worked with perfect safety in the blacksmith's fire; and the operation of flanging a boiler head is certainly no more severe a test of the forging qualities than the upsetting of an eye-bar head.

A strictly soft steel eye-bar is advocated because these, of all members of a bridge, are the ones which must be good or else irrevocably bad. A small transverse crack, for instance, which would ruin an eye-bar eventually, might not cause any difficulty whatever in a compression member, as the character of the work performed by the tension member has a continual tendency to increase the defect, while the strain in the latter tends continually to press the sides of the crack closer together. Again, while the compression member

TABLE OF STEEL REQUIREMENTS IN VARIOUS BRIDGE SPECIFICATIONS. REVISED TO SEPT. 1, 1894. COMPILED BY HARRY J. LEWIS.

Specification.	Classification of material.	Ultimate strength in 1,000 lbs.	Elastic limit.	Elongation.	Reduction, p. c.	Fracture.	Full-size members: Ult. strength.	Full-size members: Elastic limit.	Full-size members: Elongation.	Full-size members: Reduction, p. c.	Chemical requirements: Process.	Chemical requirements: Phosphorus.	Chemical requirements: Sulphur.	Bending: W = diam. of curve of bend. t = thickness of piece.	Drifting.	Reaming of punched holes.
Atlantic Coast Line		60 to 68	34,000	20 p. c. in 8"	40		60 to 68,000	34,000	14 p. c. in 10 ft.	40	Any.	0.08		180° flat		
Atchison, Topeka & Santa Fe	Compression	75 to 85	40,000	18 p. c. in 12 diams.	35									" W = t		Yes
	Tension	60 to 70	35,000	23 " "	42									" flat		
	Substitute for iron	55 to 65	30,000	23 " "	42									" "		
Baltimore & Ohio, Edition 1894	Medium	60 to 68	½ ult	20 " 8"; pins, 16 p. c.		Entirely homogeneous and free from lamitations	58,000	½ ult.	13 p. c. in 20 ft.		O. H.	Acid, 0.08 Basic, 0 05		180° flat to 1" thick; over 1" thick, 180° W = 1½ t	Twice original diameter.	No Yes
	Soft	52 to 60	½ ult.	25 " "							"	Acid, 0 08 Basic, 0 05			Twice original diameter	**
Baltimore & Ohio, Sow'n Ed., 1894	Medium—Eyebars, pins and rollers	60 to 70	36,000	23 " "	43	Clear silky grey	58,000	31,000	14 p. c. in 10 ft.	40	Any.	Acid, 0.08 Basic, 0.06	0.06 0.05	180° W = 1½ t		Yes
	Soft—Built members	54 to 62	33,000	25 " "	50	Clear silky						Acid, 0.08 Basic, 0 06	0.06 0.05	" flat		**
Bouscaren's R. R., 1890		64 to 70		20 " 12 diams.			56,000	33,000	10 p. c. in 10 ft.			0 10		Cold bend, flat.		Yes
Cincinnati, N. O. & Texas Pacific		56 to 62	33,000	25 " 8"	50		95 p. c. of spec.	95 p. c. of spec.			Any.	0.075		Quench bend, W = 1½ t Full-size bend, W = 2 t 180° flat.		Yes
Chicago, Burl & Q.	Eyebars	58 to 66	34,000	20 " "	40		54 to 62,000	32,000	15 p. c. in 20 ft.	30	O. H.			" W = t		Yes
Ches. & Ohio	Medium	60 to 68	35,000	20 " "			55,000		12½ p. c.					W = 1½ t		Yes
	Soft	52 to 60	30,000	25 " "			52,000		18 "					180° flat		
Central R. R. & B. Co. of Ga.	Compression	66 to 74	½ ult.	20 " "	30	Fine gr'd. blue grey						0 08 to 0.10		W = 3 t	1½" from edge, 25 p. c.	Yes
	Tension	62 to 68	½ ult.	20 " "	30	" " "	60,000	30,000	12½ p. c.			" "		" "		
	Rolled beams	57 to 65	½ ult.	20 " "	30	" " "						" "		" "		
Cooper's R. R., 1890	Medium	62 to 68	33,000	20 " "		Blue steel grey					Any.			" "		
	Soft	54 to 62	30,000	25 " "										180° W = 2 t		Yes
Cleveland, Cincinnati, Chicago & St. Louis	Medium—Tension members, pins, rollers and bearing plates.	60 to 70	36,000	23 " "	43	Clear silky grey	60,000	34,000	14 p. c. in full length.	40	"	Acid, 0.08 Basic, 0.06	0.06 0.05	Cold and quench, 180° flat		No Yes
	Soft—Compression members, girders, beams and channels.	54 to 62	33,000	25 " "	50	Clean silky					"	Acid, 0 08 Basic, 0 06	0.06 0.05	" " " "		**
Great Northern	Medium	60 to 68	36,000	22 " "	44		95 p. c. of spec.	95 p. c. of spec.			"	Open hearth, 0.02 Bessemer, 0 06		180° W = 2 t. tension 3 t. comp	1.25 orig diam.	Yes
	Soft—For rivets	54 to 62	36,000	22 " "	44											
	Web plates	54 to 62	35,000	28 " "	35											
Illinois Central	Flanges	60 to 68	35,000	20 " "	44											
	Rivets	54 to 62	32,000	28 " "	50											
	Compression	66 to 74	½ ult.	20 " "	30						O. H.			W = 3t	1.25 orig. diam.	Yes
Louisville & Nashville, Jan. 1, 1890	Ten. mems., pins and built beams	60 to 68	½ ult.	20 " "	30	Blue grey " "	60,000	30,000	12½ p. c.		"			" "	" " "	
	Rolled beams	57 to 65	½ ult.	20 " "	30	" "					"			" "	" " "	
	Rivets	52 to 60	30,000	25 " "												
Lake Shore & Mich. Southern		56 to 64	60 p. c. ult.	28 " "	45	Fine silky blue grey	56,000	60 p. c. ult.	15 p. c.		O. H	0.08		180° flat	1½ times orig. diam.	**
Michigan Central	All material except rivets	57 to 65	55 p. c. ult.	27 p. c. 57,000 ult. in 8". 24 " 65,000 "	45	Silky	54 to 65,000	55 " "	15 p. c. in 10 ft. 12½ " " full length.	45	"	0 08		" "		**
	Rivets	50 to 60	55 p. c. ult.	27 p. c. in 8"	50	"					"	0.08		" "		
New York Central & Hudson River		58 to 65	38,000	28 p. c. in 8" under 36" wide 24 " " over "	56						"	0 08 0 06	0.06* 0.04	" "		
New York & New England	Tension	62 to 70	36,000	1,500,000 / ult. str. p. c. in 8" = 2,800,000 / ult. str.		Blue steel grey						0.10		Flat		
N. Y., New Haven & Hartford, Old Colony System	Compression	70 to 80	42,000			" "						0 10		"		Yes
	Compression	65 to 70	0.6 ult.											"		Yes
	Tension	60 to 65	0.6 ult.											"		
	Rivets	55 to 60	0.6 ult.											"		
Norfolk & West'n, Jan. 1, 1891		60 to 70	35,000	22 p. c. in 8"	40	Silky—ductile	56,000	33,000	10 p. c.					180° flat	¾ to 1½. 1½ from edge.	Yes
Northern Pacific	Medium—Eyebars pins, beams and lg. sp. structure.	62 to 68	0.6 ult.	1,500,000 / ult. str. p. c. in 8" = 2,800,000 / ult. str.			Eyebars, 56,000.	95 p. c. of spec.	12 p. c. in full length.		Bess. or O. H.	0 085 Acid O. H. 0.06 Bess. & Basic O. H.		" W = it	¾ to 1½ diam.	Yes
	Soft—Short spans, girders, trestles, rods and rivets	56 to 62	0 6 ult.				Rods, 50,000	" " "	" " "		O. H.			" W = 4 t.; rivets flat	¾ to 1⅜ diam.	
Penn. Lines West of Pittsburg, So'west System	¾ in. round from small test ingot.	62 to 70	½ max. ult.	20 p. c. in 8"	45						"	0.08		" flat		Yes
	Specimen from finished material.	60 to 68	½ max. ult.	20 " "	45		54,000	30,000	10 p. c.		"	0 08		" "		
Pennsylvania R. R.	Eyebars	52 to 62	½ ult.	26 " "		Silky fracture, uniform color	49,000		12 p. c. in 10 ft.		"	0 08		" W = t		
	Medium—Forged tens'n members	60 to 68	33,000	22 " "	40		58,000	32,000	" " 15 "	40		0.08		" "		
Southern Ry. Co., Eastern System	Medium—Riveted compress mems.	62 to 70	34,000	20 " "	40							0.10 max. 0 08 average				Yes
	Soft—Used same as iron	54 to 62	30,000	25 " "	40							0.10 max. 0.08 average		Cold or quench, 180° flat	¾" to 1½". 1½" from edge.	No
Union Pacific	Medium	60 to 68	35,000	25 " "	45	Fine grained blue steel grey					Any.			W = 3 t		Yes
	Soft	54 to 62	33,000	25 " "	50						"			" 2 t		
Wabash	Eyebars	60 to 68	0.6 ult.	1,500,000 ÷ ult. str.	2,400,000 ÷ u. s.		95 p. c. of spec.		Same as specimen.		"			" 2 t		
City of Columbus O.		54 to 62	½ ult.	26 p. c. in 8"	50						O. H.	Basic, 0 04 Acid, 0.085		180° flat	¾ to 1½" 1½ from edge.	

Notes.—The Baltimore & Ohio Southwestern specifications provide that both medium and soft steel must stand hammering cold to one-half its original thickness. The Cleveland, Cincinnati, Chicago & St. Louis makes the same requirement for medium steel, but requires soft steel to stand hammering to one-third its thickness, and this last requirement is made in the Cincinnati, New Orleans & Texas Pacific specification. The New York Central requires all holes to be drilled except for sway bracing, which are to be punched and reamed. The Southern Ry. Co. requires that soft steel to be used the same as iron shall have holes drilled on all tension members over ⅝-in. thick and all compression members over ¾-in. thick.

* The N. Y. C. & H. R. has limits as follows: Material drilled.—Phos., .08; sulph., .06; cop., .45; man., .40. Material forged.—Phos., .06; sulph., .04; cop., .50; man., .20. ** Under "Reaming of Punched Holes," the B. & O. requires it to be done on soft steel over ⅝ in. thick, but not on thinner material. The L. S. & M. S. has the same requirement. The B. & O. Southwestern and the C., C., C. & St. L., for soft steel, and the Michigan Central for all material exceed [illegible] on ¾-in. or thicker pieces, but not on thinner material.

is being continually favored by the use of formulas for the reduction of allowed unit strain, the eye-bar receives no allowance whatever, and its unit strains are invariably much higher, which also adds to its chances of failure from flaws. The stiffness of the higher steels under strain is a serious objection to their use as tension members, where the unavoidable inaccuracies of workmanship and other causes subject them to strains which demand material of the highest possible ductility. Soft steel certainly possesses this quality in the highest degree, and therefore presents superior claims to be used in eye-bars. It is an axiom in railroad management that no company is doing its full duty unless it uses the best material to be obtained in the market, and careful consideration will show that soft steel presents very strong claims to this distinction, especially as eye-bar material.

No limit has been set on the thickness of material which may be punched, as it has not as yet been proved that good soft steel suffers any more injury than iron in punching, and late experiments would suggest that drilling or reaming injures it nearly as much as punching. It is not feasible in soft steel to punch holes whose diameter is less than the thickness of the material, as the punches will not stand it, except for a few holes in some exceptional cases, and no intelligent designer would think of requiring it, where it could be avoided. Such experiments as have been made would seem to indicate that there is no great injury either to iron or steel until the above limit has been reached, and where any considerable number of holes are required in thick material, it is probably even cheaper to drill them.

In the long span plate girders, which are becoming so common, there is often a strong temptation to use a thick flange angle in order to reduce as much as possible percentage of area in the flange plates, and indeed some specifications make an especial point of requiring the maximum thickness of angles. It is undoubtedly bad design to carry this so far as to put the material in danger of injury from punching, and it should always be avoided, even if a little larger percentage of section does find its way into the flange plates. A simple and much more effective remedy would be the production of 8 × 8-in. or 9 × 9-in. angles, which would allow three lines of rivets and increase the width of the flange plates at the same time. Rolls are now maintained by the mills for a much smaller tonnage than would be required from these as soon as designers found they could be obtained.

(Since writing the above, information has been received that at least one mill is ready to make angles of one or other of these sizes.)

The appended tables, "A" and "B" represent about two years' progress. Table "A" was prepared from information received during October of 1892, while table "B" is intended to be revised to Sept. 1, 1894. A careful comparison of information received at these two times shows three things very clearly, viz.:

1. That some specifications, which at the time of the first table did not recognize steel at all, are now the most explicit in their requirements.

2. That one road has adopted soft steel and abandoned medium steel since the first table, while others have in the mean time added soft steel to their specifications; and one road which had already adopted it has in the mean time seen its way clear to raise its requirements for ductility considerably, at the same time raising the ultimate strength by 2,000 lbs.

3. That there is a decided movement in favor of the open-hearth process, table "B" showing nine roads which use it exclusively, as against three in table "A."

Of the tables referred to above, we reproduce Table B only. The important variations between the two tables have been well summarized in Mr. Lewis' closing paragraphs.

The photographs reproduced on our inset sheet this week show samples of various tests of soft steel made by Mr. Lewis, and well illustrate its toughness and capacity to stand abuse. In connection with them, Mr. Lewis desires to acknowledge his indebtedness to Mr. Donald Fraser, Chief Inspector of the Chicago & South Side Rapid Transit Co., for assistance in the preparation of special specimens, illustrated on our inset sheet, and for access to his reports covering many hundreds of tests. Mr. S. A. Wood, Mechanical Engineer of the Keystone Bridge Works, also rendered valuable assistance in photographing all specimens.

The following is an abstract of the discussion following the reading of the above paper:

Mr. Harry J. Lewis said that he had made some experiments to determine the effect of punching upon the strength of soft steel. Several strips about 2 ins. wide were cut from a plate and prepared for testing. One was then pulled in the machine and another was punched in the middle and then pulled, the results from these two serving as standards for comparison. Another was punched and bent to an angle of about 40° and bent back, and another was placed in a vise and the free end beyond the punched hole was bent back and forth about 20° from a straight line 20 times, without sign of cracking at the hole in either specimen. These pieces were then pulled, and the ultimate strength and elastic limit of the net section across the hole were very close to that of the standard specimens. This was all soft steel, prepared on these specifications. The tendency of the work done on the specimens seemed to be toward an increase of the ultimate strength and a corresponding reduction in ductility. This is also true of other operations, such as cold rolling and wire drawing.

Mr. Emil Swensson said the principal reason why engineers demand soft steel and preferably basic open-hearth steel for bridges is that Bessemer steel is not what it used to be.

There was a time, some 15 years ago or less, when Bessemer steel of medium and even higher grade was very good and suitable for structural work. In looking up some tests of annealed eye-bars made about 12 years ago of Bessemer steel, he found they showed 70,000 lbs. ultimate strength, 40,000 lbs. elastic limit, an elongation of 20% and a reduction of 50%. Better results cannot very well be asked from an eye-bar; but such Bessemer steel is not easily obtained to-day.

In those days they made a melt about every 40 minutes, and now they make a melt in 10 or 12 minutes. This it is that has driven engineers to open-hearth steel, and finally to soft steel. He thought the ideal for steel would finally be to use it the same as iron and get it down to iron limits, using it the same as iron in all respects.

However, in using very soft steel the engineer must be very guarded on the phosphorus question, particularly in basic open hearth steel, because in the softening process the phosphorus is liable to remain as in the ordinary soft steel and the carbon may be reduced to such an extent that the steel becomes what is commonly called rotten. In other words, all the hardening ingredients should be reduced in proportion when the softest steel is desired. Of course, when it comes to long spans higher steel should be used to reduce the dead weight of structure, and uniform high steel can be made by either process if only the manufacturers can be induced to work a little slower.

In answer to remarks by Mr. Jas. M. Camp in favor of Bessemer steel, Mr. Lewis said that in addition to lack of uniformity, Bessemer metal has a tendency to break under slight provocation, particularly into or through a punched hole, the fracture showing a texture similar to cast iron. His experience is that these breaks will and do occur in material which, according to the testing machine and cold-bending test, is a soft ductile steel. He had never yet traced any similar trouble to a good soft open-hearth steel, and therefore places a degree of confidence in it which he cannot feel for Bessemer steel.

Mr. M. J. Becker said he was very glad to learn that angles with 8-in. legs were now obtainable. He had found that much of the trouble experienced in plate girder bridges was due the small angles which had to be employed in the earlier days because larger ones could not be procured, and whenever the flange area was large it would be made up by piling on cover plates, and the next thing was to drive the little thin rivets through these successive layers of metal. He had seen some of these old bridges planed through the rivet holes, and the rivets looked more like corkscrews than anything else. He would like to see the size of the legs of angles increased still further.

Referring to Mr. Lewis's statement that recent tests had shown that soft steel is no more injured by punching than by drilling or reaming, he said that samples were exhibited at the Seabright convention of the American Society of Civil Engineers which showed that punching and reaming were preferable to either punching or drilling.

Mr. Lewis, in reply, said he thought the tests referred to were made on medium steel. He had seen recent experiments which indicated that the extreme toughness of good, soft steel was a drawback, rather than an advantage, when it comes to reaming or drilling. The material seems to drag round after the tool, and does not take a good, clean cut, thereby receiving around and outside of the hole more injury than would be inflicted by a punch or die in good condition. His own experience last summer, in trying to obtain a clean finish on some large, soft steel bridge pins would confirm this idea as to the difficulty of obtaining smooth machine work.

Referring to the ultimate strength of annealed eye-bars, Mr. Swensson said that he should not favor reducing the lower limit to 52,000 lbs. and leaving the limit for the other parts of the structure at 54,000 lbs. The President, Mr. Thos. H. Johnson, called attention to the fact that there is a difference in strength between the full-sized and test specimens due to the size and shape of the section, and not to the question whether it is annealed or not.

Some years ago he plotted several hundred tests to determine the relation between the strength of the specimen and the strength of the full-size member. The specimen tests cut from the bars showed a uniform average ultimate, and elastic limit for all sections of bars without any tendency at all toward a depression of the line through the platted spots; while the tests of full-size bars showed very decidedly lowering of the ultimate and elastic limit as the ratio $\frac{\text{Area of cross-section}}{\text{Circumference of section}} = \frac{A}{C}$, increased. The tests of steel which were then available were nearly all Bessemer.

The average ultimate strength in iron full-size test was represented by the equation $55{,}000 - 15{,}000\frac{A}{C}$ while the specimen tests averaged uniformly 52,000 lbs. per sq. in. for all sizes of original bar. There was a corresponding drop in the elastic limit in full-size tests which would be represented by $34{,}500 - 1{,}150\frac{A}{C}$.

In the steel the full-sized tests would be represented by $68{,}000 - 13{,}000\frac{A}{C}$ with the elastic limit at $41{,}000 - 8{,}250\frac{A}{C}$.

THE PHYSICAL CHARACTERISTICS OF THE LAKE ERIE & WESTERN R. R.

The Lake Erie & Western R. R. has recently issued a pamphlet report, designed for the use of its managing officers and the information of its stockholders, and covering the physical characteristics of all the company's property, except its rolling stock. The report was compiled by Mr. W. F. Goltra, C. E., Secretary to the General Manager and Chief Clerk to the Chief Engineer and Purchasing Agent, and the figures given represent the system as it stood on Jan. 1, 1895.

The report is neatly bound in cloth, and makes a very convenient reference manual for the use of the company's officials. The system consists of a main line extending from Sandusky, O., to Peoria, Ill., 420 miles, with branches reaching south to Indianapolis, Connersville, and Rushville, Ind., and north to Fort Wayne and Michigan City. The report opens with the G. P. A.'s map of the line, and opposite is a sort of "family tree," showing the date when each of the component parts of the system was built and put in operation, and the changes of corporate control which it has passed through up to the present time. Following this is a right of way table, showing for each county the mileage and area of right of way tabulated according to width, and then comes a statement of the alinement and profile, accompanied by loose folding sheets, which are placed in a pocket of the cover of the book. The maximum grade is 12%, for a length of 12,200 ft., and the sharpest curve is 21° 45' for a length of 245 ft. The grades and curves on the whole road are comparatively light and few. There is one tangent 29½ miles in length.

A ballast chart shows the age and kind of ballast, the length of each stretch and its condition, the tabular summary for the main line being as follows:

Ballast.	Good, miles.	Fair, miles.	Bad, miles.	Total, miles.
Gravel, 5 to 10 years...	42.0	56.0	38.50	136.50
" 10 " 20 " ...	...	16.5	98.75	115.25
Cinders	4.0	0.5	3.00	7.50
Natural soil.....	14.0	41.2	108.39	163.59
Totals	60.0	114.2	248.64	422.84

All cross-ties in main and side tracks are of white or burr oak, except about 1% of cedar and other wood. First-class ties are of hewed oak sawed to a length of 8 ft., 8 × 6 ins. section, flattened on two opposite sides, smooth, out of wind, barked, and free from deep score marks. About 90% are of this class. The spacing varies according to the traffic and the size of ties, some of the ties being larger than specified. The number per mile ranges from 2,640 to 3,000. During the past eight years the tie renewals have averaged 253,000 per annum, and the average life, exclusive of switch and bridge ties, is 8.2 years; but in main tracks this probably does not exceed 7.5 years, while in side tracks it may reach 10 years. A few years ago the cost of tie renewals was much

less than that of rail renewals, but at present the former cost is more than twice as much as the latter. The average cost per tie was 39¾ cts. in 1891, 40¼ cts. in 1892, 42¼ cts. in 1893, and 43½ cts. in 1894.

Steel rails were first laid in 1878, and the life has been 13 years as a minimum and 27 years as a maximum, or an average of 20 years. The track now includes 77.18 miles of 52-lb., 536.30 miles of 56-lb., 44.43 miles of 60-lb. and 18.61 miles of 75-lb. steel rails. There are also 34.08 miles of 54-lb. iron rails. In regard to condition, 356.14 miles are good (showing slight wear and likely to last 10 or 20 years), 253.96 miles are fair (about half worn and good for 5 to 10 years' service), and 100.50 miles are bad (much worn, slivered, kinked and having battered ends and other defects that will necessitate renewal in four years or less.)

Other tables show particulars of 1,159 highway and street crossings (1,142 at grade, 3 overhead and 14 underway; 8 with gates, 70 with watchmen and 3 with bells), 73 railway crossings and track and stock scales. Descriptions are given of the various track signs, and their cost. Of 1,532 cattle guards, 641 are pit guards, with beveled ties, costing $21.20 each; 148 are wooden surface guards, costing $10.15, and 743 are iron or steel surface guards, costing $22.23.

Detailed statements are given of the bridges and culverts, showing the location, date of construction, number of spans and piers, type of superstructure, builder, cost of masonry per cu. yd., and cost of foundations and superstructure. There are 8 iron and steel truss bridges, 6 bridges of 18-ft. steel I-beams, 4 combination truss bridges, 4 wooden truss bridges, 47 stone and brick arches, and 26 iron and steel plate girder bridges. All bridges constructed prior to 1891 are calculated for 80-ton engine and tender, while the later ones are calculated for 100-ton engine and tender. The standard frame trestles have four-pile bents, 14 ft. c. to c., with oak caps 12 × 14 ins. × 14 ft., and two lines of stringers, each composed of two pine sticks 8 × 16 ins. × 28 ft. The ties are of oak, 6 × 8 ins. × 9 ft., boxed 1 in. over stringers and spaced 16 ins. c. to c. The floor is of decidedly poor design, the ties being spaced much too far apart and not bolted to the stringers, while the flat guard rails, 8 × 16 ins., are only bolted to every fourth tie on alternate sides. The cost of such a structure, about 15 ft. high, is $7 per ft., and the average life is nine years. Wooden trestles and waterboxes are being replaced by iron pipe culverts, 12 to 48 ins. diameter, with rubble stone masonry walls at the ends. The cost of filling in banks over such culverts, with steam shovel and unloader, averages 12 to 14 cts. per cu. yd., including wages of train crew and laborers, fuel, oil, waste and repairs. The location and length of all sidings are shown on detailed tabular statements, and the style, size, date and cost of all freight and passenger stations, engine houses, shops, section houses and miscellaneous buildings are similarly shown, as also the make, cost, etc., of turntables and water stations. The ashpits are either of the ordinary pit style or with an open-sided pit across which the track is carried by iron posts and stringers. Five methods of coaling engines are in use at different coaling stations: 1, shoveling from car to tender; 2, coal bucket and crane; 3, dump cars; 4, automatic coal chutes; 5, coaling direct from shaft of mine. The average number of engines coaled is 3,118 per month, with an average amount of 10,446 tons of coal.

The standard fence is of cedar posts, 7 ft. long, 5 to 7 ins. diameter at the small end, spaced 12½ ft. c. to c., and set 2 ft. 10 ins. in the ground. There are six lines of barbed wire, 1 lb. per rod, secured to the posts by 1½-in. staples and spaced 3 ins. (from the ground), 4 ins., 6 ins., 8 ins., 11 ins. and 14 ins. The cost per mile is about $89.60 for material and $60.80 for labor. Wing fences at road crossings are of boards, and are whitewashed in October of each year. A table shows that 754½ miles of line have fence in good condition, while 262 miles have no fence at all of any account.

There are eight interlocking plants at railway crossings, the particulars of which, with apportionment of cost and arrangements for maintenance, are duly tabulated. Similar details are given of tracks, stations and terminal facilities used jointly with other companies. The telegraph system is described in detail, and diagrams are given showing the arrangement of cross-arms and number of wires, together with the condition of the line.

The report concludes with a description of the track inspection and premium system which is adopted on this road. The inspection is made in November by the chief engineer, consulting engineer and division roadmasters, all under direction of the general superintendent, and the awards are six first premiums of $40 and six second premiums of $20. The advantages of this system in securing good track and good work from the trackmen are widely recognized, and the system is in force on many of the leading lines.

It is intended to issue this report annually, and Mr. Goltra informs us that he proposes to include in his next report plans of the yards and principal stations, and to explain the method of operation, numbering the tracks and other features, and showing each station on a separate sheet. The facility with which corrections can be made yearly is an important feature, and the foundation is such that the report can be extended and built up almost indefinitely. Illustrations can be inserted as required (the standard cattle guards and fences being shown in the present report), and many of the shorter tabular statements (such as those relating to the interlocking plants) reproduced from tracings used for blueprints. A report of this kind is more comprehensive than the ordinary "graphical chart," of which a specimen was shown in our issue of Jan. 24, and gives very much more information than can be shown upon such a chart. Mr. Goltra thinks that with the chart there is an attempt to put too much matter on the sheet, which leads to confusion, and to the adoption of an unwieldy size, and that therefore it is much better to classify and treat each subject by itself, giving its most important details and summary. The chart, however, possesses certain advantages in itself, especially for use in the railway offices, as it shows at a glance the location and character of the various works; but the report is in many ways more convenient, as it can be more easily carried about, and it can give detailed descriptions and details which cannot be given on a chart.

WEATHER TABLE FOR MARCH, 1895. (Furnished to Engineering News by the Department of Agriculture.)

	Stations.	Temperature. (Deg. Fahr.) Average.	Max.	Min.	Range.	Wind. Velocity in miles per hour. Average.	Max.	Direction at time of max. velocity.	Precipitation—rain or melted snow—inches. Total.	Heaviest in 24 hours.	No. of rainy days.
Northern Cities.	Northfield, Vt.	22.2	45	— 6	51	10.2	45	W	1.36	0.42	12
	Portland, Me.	29.4	46	4	42	8.1	28	NW	3.37	1.20	12
	New York, N. Y.	36.4	63	16	47	14.4	64	NW	2.80	0.82	12
	Pittsburg, Pa.	35.4	63	16	47	7.8	35	NW	1.73	0.34	7
	Chicago, Ill.	31.7	80	9	71	20.0	50	NE	1.32	0.73	7
	Omaha, Neb.	37.4	85	0	85	9.8	36	N	0.99	0.53	6
	St. Paul, Minn.	28.2	60	— 7	67	9.9	38	W	0.85	0.53	7
	Duluth, Minn.	23 3	52	—14	66	12.7	46	NE	0.48	0.47	3
	Bismarck, N. Dak.	27.4	72	—22	94	11.4	42	NW	0.24	0.13	3
	Average	30.3	63	— 0	63	11.6	43		1.46	0.57	8
Southern Cities.	Washington, D. C.	41.8	74	22	52	9.3	39	NW	2.59	0.83	11
	Louisville, Ky.	44.0	96	21	65	10.4	40	SW	2.10	0.58	14
	St. Louis, Mo.	44.1	85	15	70	13.6	46	S	2.82	0.86	13
	Savannah, Ga.	58.4	84	37	47	9.1	32	NW	5.31	2.44	10
	Kansas City, Mo.	42.2	88	8	80	10.7	35	NW	0.95	0.70	10
	Jacksonville, Fla.	63.0	84	40	44	8.4	42	SW	3.63	1.48	7
	Chattanooga, Tenn.	49.8	85	23	62	7.6	43	W	5.86	1.67	15
	New Orleans, La.	62.2	81	39	42	10.1	37	N	3.81	1.67	12
	Memphis, Tenn.	52.8	87	28	59	7.3	32	NW	7.01	2.06	14
	Palestine, Tex.	58 3	85	27	58	8.6	28	SW	2.52	0.74	10
	Average	51.7	84	26	58	9.5	37		3.66	1.30	12
Western Cities.	Helena, Mont.	32.4	69	—10	79	9.2	42	N	0.29	0.20	5
	Port Angeles, Wash.	42.0	59	30	29	5.0	34	W	1.40	0.33	14
	San Francisco, Cal.	52.2	70	40	30	9.6	36	SE	1.89	0.67	9
	Salt Lake City, Utah	40.8	76	16	60	7.9	40	S	0.81	0.32	7
	Santa Fe, N. Mex.	39.8	66	19	47	7.7	45	SW	0.54	0.40	5
	Denver, Colo.	37.2	76	— 1	77	8.8	48	NE	1.19	0.·0	6
	Yuma, Ariz.	64.5	97	38	59	7.5	34	W	Trace	Trace	0
	Average	44.1	73	19	54	8.0	40		0.87	0.39	7

UNDERWRITERS' RULES FOR ELECTRIC WIRING.*

By Prof. Wm. A. Anthony.

The object of all underwriters' rules for electric wiring is, first, to secure a safe and permanent installation; second, to provide for the repair or renewal of conductors in case of failure. It may be said that, from the standpoint of the insurance companies, the first is the only object; but, surely, conductors so installed that they can be easily overhauled and replaced in case leakage is discovered are safer for the very reason that a fault is likely to be repaired before any serious damage has occurred.

When highly insulated wires, whose insulation resistance was measured in megohms per mile after immersion in water for weeks, came into use for electric lighting plants, it was natural to suppose that they could be put anywhere, and would last indefinitely. They were put in all sorts of inaccessible places; on the beams before floors were laid, in partitions before plastering, on the lath with iron staples to be covered with mortar. Some such circuits are no doubt in existence to-day, as perfect in insulation as when first put up; but numberless cases of failures of insulation occurred, and experience shows that such a construction is entirely unreliable. Then came the interior conduit, which it was assumed would serve both as a mechanical protection and an insulator, but it was found not to be entirely reliable in either capacity. It was not impervious to moisture; it was subject to damage by nails, saws and chisels. It was found necessary to prescribe that wire of the highest insulation should be used in it, and that it should not be drawn in until all danger from mechanical injury was passed. Then came the brass-armored conduit; but that was not nail-proof. Now we have the iron armored conduit, and it remains to be seen whether this will fulfill all requirements.

It has come to be pretty well recognized that no mode of electrical construction is absolutely proof against failure at some point, and that form of construction is best which affords the smallest chance for injury or depreciation, and offers the greatest facilities for repair or renewal in case of failure.

There has been a uniform progress in the direction of greater safety and better facilities for repair, from the time when wires were put anywhere, to be covered by floors, or mortar, or built into brick walls, to the iron-armored conduit which is offered to-day. To be sure, the cost of the installation has advanced, and the iron-armored conduit presents difficulties when alternating currents are employed. To me it seems that the advantages gained are worth the cost, and the difficulty with alternating currents disappears if the two conductors are placed in one conduit. To this I can see no possible objection when the conduit is iron armored.

In view of the fact that we cannot be absolutely certain that failures in insulation will not occur in any given installation, it seems to me that the foundation principle of all rules for the placing of conductors should be accessibility. Further, no conductor should be placed where its position or its relation to other conductors in any part of its length is unknown. This means that raceways must be provided, into which conductors may be drawn, and from which they may be removed at pleasure, such raceways to serve as adequate protection from mechanical injury; or the conductors must be placed in moldings which are themselves accessible, or they must be supported by cleats or insulators in plain sight.

I believe that past experience would warrant the adoption of a rule that would require the use, for concealed work in buildings of fireproof construction, where conductors must be carried up steel columns, over steel floor beams, in brick partitions, or in plastered walls, of a raceway or conduit, equal in its ability to afford mechanical protection to that known as iron-armored conduit, so installed that conductors could be drawn in or out at any time.

* Extract from a paper read before the American Institute of Electrical Engineers.

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PERSONALS.

Mr. Donald McRae has been appointed City Engineer of Santa Fe, N. M.

Mr. William G. Wilkins has been appointed City Engineer of Allegheny, Pa.

Mr. Darwin E. Wright has been appointed Director of Public Works at Cleveland, O.

Aldermen Conr, Kelly and Long have been elected Water Commissioners of Dallas, Tex.

Mr. Wm. H. Barnes has been appointed City Engineer of Topeka, Kan., for a term of two years.

Mr. Frank T. Rutan has been appointed Supervising Architect of the new post office building at Allegheny, Pa.

Mr. Cabell Breckenridge is in charge of the eastern work of the Tennessee Central R. R., with offices at Rockwood, Tenn.

Mr. E. L. Corthell, M. Am. Soc. C. E., has returned to this country after a long stay in Europe, where he has been for his health.

Mr. H. C. Ripley, of Galveston, Tex., has been appointed Resident Engineer of the jetty work at the mouth of the Brazos River, at Velasco, Tex.

Mr. J. A. Dodson has been appointed General Roadmaster, and Mr. D. W. Lum, Superintendent of Bridges and Buildings, of the Southern Ry. system.

Mr. Lyman L. Gerry, formerly City Engineer of Dover, N. H., has been appointed Engineer and Superintendent of Streets for the town of Stoneham, Mass.

Mr. C. C. McCain, Auditor of the Interstate Commerce Commission, will resign that position June 1 to become Commissioner of the Association of Lake Traffic Lines, at Buffalo, N. Y.

Mr. B. R. Felton, Assoc. M. Am. Soc. C. E., has resigned his position as City Engineer of Marlborough, Mass., to accept that of principal assistant to Mr. M. M. Tidd, M. Am. Soc. C. E., of Boston, Mass.

Mr. G. Loomis Allen, for the past three years a member of the firm of Mather & Allen, of Syracuse, N. Y., has been engaged by the Syracuse Street Ry. Co. as its Engineer and Superintendent of Tracks.

Mr. Thomas H. Mather has retired from the firm of Mather & Allen, civil engineers, Syracuse, N. Y., to accept the position of Chief Engineer of the Geneva, Waterloo & Cayuga Lake Traction Co., the Syracuse & East Side Ry. Co., and other electric railways in which C. D. Beebe, of Syracuse, N. Y., and Thomas Craig, of Trenton, N. J., are interested.

Mr. W. A. Drake has been appointed Superintendent of Track, Bridges, Buildings and Water Service of the Santa Fe, Prescott & Phoenix Ry., with offices at Prescott, Ariz. Mr. R. R. Coleman, heretofore in charge of the above, will remain in the service of the company in the capacity of Superintendent of Transportation. Mr. W. L. Wallace has been appointed Superintendent of Motive Power, Machinery and Rolling Stock.

Mr. George M. Phelps, M. Am. Inst. El. Engrs., President of the "Electrical Engineer," died in Brooklyn, N. Y., April 11, at the age of 52. He was a native of Troy, N. Y., and his father was a well-known electrical inventor, being the originator of the Phelps ticker, Phelps telephone, etc., the patents for which were acquired by the Western Union Telegraph Co. In 1861 he entered the shops of the American Telegraph Co., and from 1871 till 1879 he was assistant to his father in the Western Union Telegraph Co.'s works in New York. In 1879 the company gave up manufacturing, and sold out this part of its business to the Western Electric Co., with which company Mr. Phelps remained as Superintendent until 1885. In 1886 he and Mr. Franklin L. Pope acquired an interest in the "Electrician and Electrical Engineer," a monthly paper, which they eventually made a weekly under the name of the "Electrical Engineer." He became president and general manager of the publishing company. He was a charter member of the American Institute of Electrical Engineers, was elected one of the managers in 1885, and was its treasurer from 1887 to the time of his death.

Mr. C. H. Hudson, who has been appointed Chief Engineer of the Southern Ry., is a native of Westminster, Mass., and a graduate of Harvard University. From 1867 to 1869 he was in the engineering department of the Chicago, Burlington & Quincy Ry., and then Superintendent of the Chicago Division until 1872, when he became General Superintendent of the Chicago, Clinton & Dubuque and the Chicago, Dubuque & Minnesota railways. In 1874 he returned to the C., B. & Q. R. R., as Assistant General Superintendent. In 1877 he became Superintendent of the lines of the Baltimore & Ohio R. R. west of the Ohio River, and in 1881 he left that position to become General Manager of the Minneapolis & St. Louis R. R. From 1883 to 1885 he was Superintendent of the Chesapeake & Ohio and Kentucky Central railways, and from 1885 to 1888 was General Manager of the East Tennessee, Virginia & Georgia R. R., after which he became also General Manager of the Memphis & Charleston R. R. He was subsequently made General Superintendent of the same roads, and still later he was restored to the title of General Manager, and remained until the reorganization of the Southern Ry., when he was retained in charge of the same properties.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

INDIANAPOLIS ENGINEERING CLUB.
April 27. Secy., C. C. Brown, City Engineer.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
May 1. "Preservation of Iron Structures Exposed to the Weather," by E. Gerber. Secy., C. W. Hunt, 127 E. 23d St., N. Y. city.
ENGINEERS' CLUB OF ST. LOUIS.
May 1. "The Design of the Trainshed of the new Union Station at St. Louis," by George H. Pegram. Secy., W. H. Bryan, Turner Block.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
May 3. Secy., O. H. Von Geldern, 819 Market St., San Francisco.
ENGINEERING CLUB OF COLUMBUS, O.
May 4. Secy., David Buell.
ENGINEERS' CLUB OF PHILADELPHIA.
May 4. Secy., L. F. Rondinella, 1122 Girard St.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
May 6. Secy., C. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
May 6. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N.Y.
COLUMBIAN ENGINEERING SOCIETY.
May 7. Secy., W. F. Hart, University Building, 15th and H. Sts. N. W., Washington, D. C.
NEW ENGLAND RAILROAD CLUB.
May 8. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 8. "Compound Locomotives," by F. W. Dean. Secy., F. R. Hutton, 12 W. 31st St., N. Y. city.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
May 9. Secy., James K. Zollinger, Norton Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
May 9. Secy., H. D. Ruhm, Nashville, Tenn.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
May 9. Secy., C. H. McLeod, 12 Mansfield, St., Montreal.
MONTANA SOCIETY OF CIVIL ENGINEERS.
May 11. Secy., Forrest J. Smith, Denver Block, Helena, Mont.
ENGINEERS' CLUB OF KANSAS CITY.
May 13. Secy., F. W. Tuttle, Baird Building.
NORTHWESTERN SOCIETY OF ENGINEERS.
May 14. Secy., D. W. McMorris, Burke Building, Seattle, Wash.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
May 14. Secy., F. A. Coburn, Case Library Building.
NORTHWEST RAILWAY CLUB.
May 14. Secy., C. A. Seley, Metropolitan Block, St. Paul, Minn.
WISCONSIN POLYTECHNIC SOCIETY.
May 14. Secy., W. K. Means, Loan & Trust Building, Milwaukee.
DENVER SOCIETY OF CIVIL ENGINEERS.
May 14. Secy., H. Breen, 36 Jacobson Block.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
May 15. Secy., J. H. Pilcher, Roanoke, Va.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
May 15. Secy., F. Van Vleck, Los Angeles, Cal.
WESTERN SOCIETY OF ENGINEERS.
May 15. Secy., Chas. J. Roney, 1736 Monadnock Block, Chicago.
BOSTON SOCIETY OF CIVIL ENGINEERS.
May 15. Secy. S. E. Tinkham, City Hall, Rooms 36 Bromfield St.
NEW YORK RAILROAD CLUB.
May 16. Secy., John A. Hill, 256 Broadway, N. Y. city.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
May 16. Secy., D. Carhart, Carnegie Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
May 16. Secy., J. F. Wilson, Odd Fellows' Temple.
ENGINEERS' CLUB OF MINNEAPOLIS.
May 20. Secy., E. Nexson, Kasota Block.
WESTERN RAILWAY CLUB.
May 21. Secy., W. D. Crosman, Club Room 9, Grand Pacific Hotel, Chicago.
MASTER CAR BUILDERS' ASSOCIATION.
June 11. Annual Convention at Alexandria Bay, N. Y. Secy., J. W. Cloud, Rookery Building, Chicago, Ill.
ASSOCIATION OF RAILWAY TELEGRAPH SUPTS.
June 12. Montreal, Que. Secy., P. W. Drew, Wisconsin Central Ry., Milwaukee, Wis.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
June 14. Secy., D. W. Meeker, St. Paul, Minn.
AMERICAN RAILWAY MASTER MECHANICS' ASSOC'N.
June 17. Annual Convention at Alexandria Bay, N. Y. Secy., Angus Sinclair, 256 Broadway, New York city.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting on April 17 Prof. Leonard S. Smith, of the University of Wisconsin, Madison, Wis., read a paper on "An Experimental Study of Field Methods which will Insure Greatly Increased Accuracy to Stadia Measurements." The author had had occasion to make an exhaustive study of stadia methods and the effect of work done at various hours of the day, and under varying conditions of the atmosphere. Two points were covered: First, a study of what is known as boiling or unsteadiness of the air, the effect of which he termed differential refraction. Second, the effect of this refraction upon the accuracy of stadia measurements. The author had spent considerable time on this work, in connection with the international boundary survey between this country and Mexico, and his experiments were continued last summer at Madison, Wis. His researches enabled him to formulate some general suggestions regarding stadia work, which, if followed, would enable that system to be employed satisfactorily on work requiring a greater degree of accuracy than has heretofore been deemed possible. William H. Bryan, Secy.

MONTANA SOCIETY OF CIVIL ENGINEERS.—At the meeting at Helena, Mont., on April 13, Mr. J. H. Farmer read a paper on "Steam Power in Relation to Our Mills and Manufactures, Compared with Water Power by Electrical Transmission." The paper entered into the details of construction and cost of building a dam across the Missouri River, near Stubbs's ferry, and transmitting the power by electricity to Helena. It also developed the facts that the results obtained by recent tests, made on two of the largest plants in the state, show that the power can be transmitted from the dam to Helena at $16.78 per HP. per year. A careful estimate shows that Helena now uses about 2,000 HP.

NEW PUBLICATIONS.

NEW JERSEY STATE BOARD OF HEALTH.—Report for the Year 1894, together with Report of the Bureau of Vital Statistics for the Year Ending June 30, 1894. Henry Mitchell, M. D., Secretary, Trenton, N. J. 8vo; paper; pp. 479; two illustrations and many tables.

This report contains a brief description of the garbage crematory at Atlantic City, with a view and longitudinal section, and an abstract of a paper by Mr. Parker N. Black, C. E., of Asbury Park, on the Ventilation of the Separate System of Sewerage (see Eng. News Dec. 30, 1894).

ENLARGED BUSINESS ATLAS, 1895.—Atlas of the United States. Chicago, Ill.: Rand, McNally & Co. Cloth; 21 × 15 ins.; pp. 384; 101 maps; $12.50.

The edition of this well-known atlas for the current year has the usual clear and complete maps, with abundance of references marked thereon, but there is a decided change in the way in which the railways are shown. In former editions all the railways were shown by black lines, and the different systems were distinguished by dots, crosses, etc., of different colors. In the present edition all the railways are in red lines, and the different systems are indicated by numbers and reference lists, which does not appear to be so convenient as the old arrangement. There is an unusually large number of city maps, no less than 21 American cities having special maps.

TRADE PUBLICATIONS.

VALVES AND HYDRANTS.—The Ludlow Valve Mfg. Co., Troy, N. Y. Oblong 12mo; pp. 106.

This is a price list and illustrated catalogue, showing fully the various valves and hydrants made by this well-known company.

PAINT FOR PROTECTING IRON AND STEEL.—Prince Mfg. Co., 71 Maiden Lane, New York city. Paper; 8vo.; pp. 32.

This pamphlet contains a description of Prince Bros.' "mineral brown" paint, which is made from roasted iron ore, and is said to prevent all rusting and corrosion. Particulars are given of its use for tender tanks, cars, bridges, buildings, naval ordnance, cannon and shot, etc.

COAL-MINING MACHINERY AND PLANT. Ingersoll-Sergeant Drill Co., 26 Cortlandt St., New York city. Cloth; 4to; pp. 115; illustrated.

This catalogue shows a number of air compressors and compressor plants; the use of drills in sinking, drifting and stoping; machinery for shaft sinking, and different applications of the company's coal-cutting machine, together with particulars of its use. Besides these there are particulars of core, hand, and prospecting drills; electric locomotives, the Pohle air-lift pump, etc.; and also of boilers, tools, rope, pipe and general supplies. In addition to the trade matter considerable space is devoted to descriptions of machinery and plant, tables of useful information, and reprints of articles relating to mining and compressed-air work. There are also detailed estimates of the cost of a complete coal-mining plant and the cost of operation.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Apr. 26.	Electric lighting,	Greensboro, N. C.	Apr. 4
Apr. 26.	Officers' quarters,	Helena, Mont.	Apr. 11
Apr. 26.	Street improvements,	St. Louis, Mo.	Apr. 18
Apr. 26.	Sewers,	St. Louis, Mo.	Apr. 18
Apr. 26.	Exposition buildings,	Atlanta, Ga.	Apr. 18
Apr. 26.	Repaving, etc.,	Philadelphia, Pa.	Apr. 18
Apr. 27.	School Bldg.,	Jefferson City, Mo.	Apr. 18
Apr. 27.	Buildings,	Phoenix, N. Mex.	Apr. 18
Apr. 27.	Railway (6¼ miles),	Wilmington, N. C.	Apr. 25
Apr. 27.	Sewers (6 miles),	Medford, Mass.	Apr. 25
Apr. 29.	Paving,	Montgomery, Ala.	Apr. 4
Apr. 29.	Dredging,	Wilmington, Del.	Apr. 4
Apr. 29.	Roads,	Detroit, Mich.	Apr. 11
Apr. 29.	Bonds ($200,000),	Minneapolis, Minn.	Apr. 18
Apr. 29.	Completing dry dock,	B'klyn navy yd.	Apr. 18
Apr. 29.	Bridge,	Louisville, Ky.	Apr. 18
Apr. 29.	Bonds ($100,000),	Newport, R. I.	Apr. 18
Apr. 29.	Stone paving,	Worcester, Mass.	Apr. 25
Apr. 29.	Stone paving,	Jersey City, N. J.	Apr. 25
Apr. 30.	Keeping Mobile River clear of timber.		Apr. 4
Apr. 30.	Cement, stone, etc.,	Mobile, Ala.	Apr. 4
	Advertised, Eng. News, Apr. 4 to 25.		
Apr. 30.	Street improv't bonds,	Mt. Pleasant, O.	Apr. 4
Apr. 30.	Sea wall,	Baltimore, Md.	Apr. 11
Apr. 30.	Post office building at	Rimouski, Que.	Apr. 11
Apr. 30.	Cement (25,000 lbs.),	Ottawa, Ont.	Apr. 11
Apr. 30.	Reservoir,	Minneapolis, Minn.	Apr. 18
Apr. 30.	Pipe, valves, etc.,	Minneapolis, Minn.	Apr. 18
Apr. 30.	Brick paving (5 streets),	Cincinnati, O.	Apr. 18
Apr. 30.	Steel plates, etc., Mare Island navy yd.		Apr. 18
Apr. 30.	Macadamizing (3¾ miles),	Kansas City.	Apr. 18
Apr. 30.	Brick paving,	Tipton, Ind.	Apr. 18
	Advertised, Eng. News, Apr. 18 and 25.		
Apr. 30.	Bridge,	Kansas City, Mo.	Apr. 18
Apr. 30.	Jail,	Dawson, Ga.	Mar. 28
Apr. 30.	Pipe sewers,	Indianapolis, Ind.	Apr. 25
Apr. 30.	Pipe sewers,	Jamaica Plain, Mass.	Apr. 25
Apr. 30.	Brick paving,	Des Moines, Ia.	Apr. 25
Apr. 30.	Building street,	Jamaica Plain, Mass.	Apr. 25
Apr. 30.	Paving,	Indianapolis, Ind.	Apr. 25
Apr. 30.	Brick paving,	Cincinnati, O.	Apr. 25
Apr. 30.	Cement,	Minneapolis, Minn.	Apr. 25
Apr. 30.	Float stage,	New York, N. Y.	Apr. 25
May 1.	Sewer system,	Sudbury, Ont.	Mar. 28
May 1.	Water-works system,	Sudbury, Ont.	Mar. 28
May 1.	Buildings,	New Orleans, La.	Mar. 28
	Advertised, Eng. News, Mar. 28 to Apr. 18.		
May 1.	Metalwork,	New Orleans, La.	Mar. 28
	Advertised, Eng. News, Mar. 28 to Apr. 18.		
May 1.	Water bonds ($10,000),	Cascade, Ia.	Apr. 4
May 1.	Stone and asphalt paving,	Cleveland.	Apr. 4
May 1.	Dredging,	Oswego, N. Y.	Apr. 11
May 1.	Post office building,	Bloomington, Ill.	Apr. 11
May 1.	Brick paving,	Peoria, Ill.	Apr. 11
	Advertised, Eng. News, Apr. 11 to 25.		
May 1.	Sewers (20 miles),	Williamsbridge, N. Y.	Apr. 11
	Advertised, Eng. News, Apr. 11 to 25.		
May 1.	Drill hall,	Plattsburg, N. Y.	Apr. 11
May 1.	Road, etc.,	New York, N. Y.	Apr. 18
May 1.	Pumping station,	Russell, Kan.	Apr. 18
May 1.	Pumping station,	Ulysses, Kan.	Apr. 18
May 1.	Floodwater channel,	Altoona, Pa.	Apr. 18
	Advertised, Eng. News, Apr. 18.		
May 1.	Water-works system,	Grantsburg, Wis.	Apr. 18
May 1.	Bridge,	Chestertown, Md.	Apr. 18
May 1.	Bridge,	Kieler, Wis.	Apr. 18
May 1.	Electric lighting,	Listowel, Ont.	Apr. 25
May 1.	Sea wall,	Cambridge, Mass.	Apr. 25
May 1.	Stone paving,	Waterbury, Conn.	Apr. 25
May 1.	Artesian well,	Italy, Tex.	Apr. 25
May 1.	Paving,	Baltimore, Md.	Apr. 25
May 1.	Brick paving,	Lock Haven, Pa.	Apr. 25
May 2.	Pipe sewers,	Barrie, Ont.	Apr. 18
May 2.	Macadamizing (3 miles),	Kansas City, Mo.	Apr. 18
May 2.	Macadamizing, etc.,	Barrie, Ont.	Apr. 18
May 2.	Dredging,	Detroit, Mich.	Apr. 18
	Advertised, Eng. News, Apr. 18 and 25.		
May 2.	Jail,	Grand Rapids, Mich.	Apr. 18
May 2.	Ferrules (11,500),	Chicago, Ill.	Apr. 25
May 2.	Pipe and boilers,	Yonkers, N. Y.	Apr. 25
May 2.	Exhibition buildings,	Atlanta, Ga.	Apr. 25
May 2.	Jail,	Grand Rapids, Wis.	Apr. 25
May 3.	Brick sewers,	Richmond, Ind.	Apr. 11
May 3.	Pipe sewers,	Richmond, Ind.	Apr. 11
May 3.	Life saving station at	Gay Head, Mass.	Apr. 18
	Advertised, Eng. News, Apr. 18 and 25.		
May 3.	Cement, etc.,	Washington, D. C.	Apr. 25
May 3.	School building,	Providence, R. I.	Apr. 25
May 3.	Telegraph supplies,	Brooklyn, N. Y.	Apr. 25
May 3.	Grading, etc.,	Washington, D. C.	Apr. 25
	Advertised, Eng. News, Apr. 25.		
May 4.	Roads (7½ miles),	Vevay, Ind.	Apr. 4
May 4.	Cast iron pipe,	Homestead, Pa.	Apr. 25
May 4.	Brick, cement, etc.,	Toronto, Ont.	Apr. 25
May 4.	Paving,	Des Moines, Ia.	Apr. 25
May 4.	Pipe sewers,	Westport, Mo.	Apr. 25
	Advertised, Eng. News, Apr. 25.		
May 4.	Electric fire alarm,	Cobourg, Ont.	Apr. 25
May 6.	Bridges,	Los Angeles, Cal.	Apr. 11
May 6.	Sewers,	Cincinnati, O.	Apr. 11
May 6.	Paving,	Cincinnati, O.	Apr. 11
May 6.	Bridge,	Meridian, Miss.	Apr. 18
May 6.	Brick paving,	Erie, Pa.	Apr. 25
	Advertised, Eng. News, Apr. 25 and May 2.		
May 6.	Flagging,	Brooklyn, N. Y.	Apr. 25
May 6.	Main sewer,	Brooklyn, N. Y.	Apr. 25
May 6.	Asphaltum block paving,	Erie, Pa.	Apr. 25
	Advertised, Eng. News, Apr. 25 and May 2.		
May 6.	Asphalt block paving,	Poughkeepsie.	Apr. 25
May 6.	Dredging, etc.,	Lorain, O.	Apr. 25
	Advertised, Eng. News, Apr. 25 and May 2.		
May 6.	Cast iron pipe,	Syracuse, N. Y.	Apr. 25
	Advertised, Eng. News, Apr. 25.		
May 6.	Sheet asphalt paving,	Erie, Pa.	Apr. 25
	Advertised, Eng. News, Apr. 25 and May 2.		
May 7.	Paving,	Terre Haute, Ind.	Apr. 11
May 7.	Bridge,	Houghton, Mich.	Apr. 18
May 7.	Water-works system,	Scranton, Miss.	Apr. 25
May 7.	Pipe sewers,	Buffalo, N. Y.	Apr. 25
May 7.	Iron Bridge,	Buffalo, N. Y.	Apr. 25
May 8.	Well, near	San Antonio, Tex.	Apr. 25
May 8.	Macadamising,	Alfred, N. Y.	Apr. 25
	Advertised, Eng. News, Apr. 25 and May 2.		
May 8.	Paving,	Hoboken, N. J.	Apr. 25
May 9.	Courthouse,	Decatur, Tex.	Apr. 18
May 9.	Pipe sewers,	Williamsport, Pa.	Apr. 25
	Advertised, Eng. News, Apr. 25.		
May 9.	Stand-pipe,	Schenectady, N. Y.	Apr. 25
	Advertised, Eng. News, Apr. 25.		
May 10.	Bridge,	Plymouth, Ind.	Apr. 11
May 10.	Paving,	St. Louis, Mo.	Apr. 25
May 10.	Drill hall,	Newport, Ky.	Apr. 25
May 11.	Stone,	Pittsburg, Pa.	Apr. 18
	Advertised, Eng. News, Apr. 18 to May 2.		
May 11.	Schoolhouse,	Cleveland, O.	Apr. 18
May 11.	Pumping station,	Dighton, Kan.	Apr. 25
May 11.	School building,	Cleveland, O.	Apr. 25
May 11.	Bridges,	Leavenworth, Kan.	Apr. 25
May 11.	Iron fence,	Napoleonville, La.	Apr. 25
May 13.	Plans for court house,	Liberty, Tex.	Apr. 11
May 13.	Sewers,	Yonkers, N. Y.	Apr. 18
May 13.	Brick paving,	Carbondale, Pa.	Apr. 25
	Advertised, Eng. News, Apr. 25 to May 9.		
May 14.	Levee (600,000 cu. yds.),	Rock Island, Ill.	Apr. 18
	Advertised, Eng. News, Apr. 18 to May 9.		
May 14.	Coal,	Wilmington, N. C.	Apr. 18
	Advertised, Eng. News, Apr. 18 to May 9.		
May 15.	Smokeless powder,	Washington, D. C.	Apr. 4
May 15.	Bridge,	Glendive, Mont.	Apr. 4
May 15.	Memorial hall,	West Point, N. Y.	Apr. 11
	Advertised, Eng. News, Apr. 11 to May 2.		
May 15.	Plans, etc., for bridge,	Montreal	Jan. 24
	Advertised, Eng. News, Jan. 24 and 31.		
May 15.	Barracks, etc., at	Fort Myer, Va.	Apr. 18
May 15.	Bonds ($215,000),	Schenectady, N. Y.	Apr. 18
May 15.	Telephone franchise,	Jackson, Tenn.	Apr. 25
May 16.	Dredging,	Philadelphia, Pa.	Apr. 25
May 16.	School building,	Toledo, O.	Apr. 25
May 18.	Stone buildings, at	Santa Fe, N. Mex.	Apr. 25
May 18.	Lock,	St. Louis, Mo.	Apr. 25
	Advertised, Eng. News, Apr. 18 to May 9.		
May 18.	Remodeling school building,	Cleveland, O.	Apr. 25
May 20.	Water bonds,	Santa Clara, Cal.	Mar. 7
	Advertised, Eng. News, Mar. 7 to 28.		
May 20.	Court-house,	Wrightsville, Ga.	Apr. 4
May 21.	Dredging,	Montgomery, Ala.	Apr. 18
	Advertised, Eng. News, Apr. 18 to May 9.		
May 21.	Pumping engines, etc.,	Brooklyn, N. Y.	Apr. 11
	Advertised, Eng. News, Apr. 11 and 25.		
May 25.	Water-wks. system,	Santa Clara, Cal.	Mar. 7
	Advertised, Eng. News, Mar. 7 to 28.		
May 23.	Bridge,	Winnipeg, Man.	Apr. 18
May 28.	Jail,	Brazil, Ind.	Apr. 25
Jun. 1.	Electric lighting,	Vancouver, B. C.	Apr. 25
Jun. 3.	Courthouse plans,	Winfield, W. Va.	Apr. 18
Jun. 7.	Bridge,	Versailles, Ind.	Apr. 18
Jun. 15.	Irrigation canal,	Portland, Ore.	Apr. 18
July 3.	Bridges,	Ukiah, Cal.	Apr. 18
Aug. 5.	Plans for state capitol,	St. Paul, Minn.	Apr. 25
Oct. 1.	Plans for art building,	Philadelphia, Pa.	Apr. 11
No date.	Electric railway materials,	Bristol, Ct.	Apr. 25
"	Sinking well,	Farnhurst, Del.	Apr. 25
"	Artesian well,	Dallas, Tex.	Apr. 25
"	Electric light plant,	Tamaqua, Pa.	Apr. 25
"	Electrical equipment,	Denison, Tex.	Apr. 25

RAILWAYS.

East of Chicago.

BUFFALO & SUSQUEHANNA.—Work was commenced last week on an extension from Galeton to Brookland, Pa., 11 miles, and it is reported that the road will ultimately be extended on to Genesee Forks. Frank Greco, of Bradford, Pa., has the contract for grading the extension.

INDIANA CENTRAL.—Incorporated in Indiana to build an air-line railway from Cleveland, O., to St. Louis, Mo., 476 miles, passing through Decatur, Bluffton, Marion, Tipton, Crawfordsville and Newport, Ind., with a branch from Marion to Huntington and Fort Wayne, 45 miles; directors, Jas. H. Cable, Lafayette, Ind. (chief projector); Hopkins J. Hanford, Edward J. Leszensky and Jas. H. Parish, of Chicago; Richard Neptune, Thorntown, Ind.; A. F. Ramsey, Crawfordsville, Ind.; David Overman, Marion, Ind. It is stated that the road will pass through 18 county seats, and be 70 miles shorter than any existing railway between Cleveland and St. Louis. Pres., J. H. Cable; Vice-Pres., H. J. Hanford; Secy., J. H. Parish; Treas., E. J. Leszensky; Attorney, Geo. P. Haywood, Lafayette, Ind.

SCRANTON & BALD MOUNT.—Incorporated in Pennsylvania April 22 to build a steam railway from Luzerne St., in the city of Scranton, through the townships of Ransom and Lackawanna to Bald Mount, a reported distance of five miles; capital stock, $100,000; Pres., Henry M. Archer; directors, P. S. Page and Grant Freeman, all of Scranton, Pa.

SOUTH JERSEY.—Francis I. Gowan, Receiver, was recently granted permission to issue $100,000 in receiver's certificates to settle outstanding accounts and to build a branch line from Petersburg to Ocean City, N. J. It is stated that oak ties will be laid instead of pine along the road, and new general offices will be erected at Cape May and new stations at Bennett, Rio Grande, Cape May Court House, Dennisville, Woodbine, Tuckahoe, Richland and Estelle.

Southern.

ATLANTIC COAST LINE.—Bids are asked until April 27 for the gradation and trestle work connecting the branch of the Charleston & Northern at Elloree, Orange county, S. C., with the Manchester & Augusta, near the Monck's Corner road, 6¼ miles. F. Gardner, Engr., A. C. L. Co., Wilmington, N. C., who has charge of the work, writes us that the contract has been virtually let.

DRY FORK.—It is stated that this railway will be extended about 100 miles within one or two years. It now extends from Hendricks to Horton, W. Va., about 30 miles, and is opening up an extensive timber and mineral country. Supt., F. K. Bretz, Hendricks, W. Va.

FLORIDA CENTRAL & PENINSULAR.—Press reports again state that this company is preparing to build an extension from Quincy, Fla., to Birmingham, Ala., about 250 miles. Ch. Engr., B. Burwell, Jr., Jacksonville, Fla.

HINTON, NEW RIVER & WESTERN.—Incorporated in West Virginia April 15 to build a railway from Hinton, W. Va., up the New River into Virginia, thence up Blue Stone River to coal fields adjacent to the Flat Top coal region, and thence back to a point near Charleston, W. Va.; capital stock, $50,000, commencing with $500; incorporators, J. T. McCreery (Pres.) and J. H. Miller, of Hinton, W. Va., and J. A. Parker, M. J. Cook and R. R. Flannagan, of Summers county, W. Va. This is a reincorporation of the Hinton & New River R. R. Co., and the construction of the road was commenced at Hinton about Feb. 1, but was discontinued pending the changing of the plans. It is expected that work will soon be resumed. Ch. Engr., R. H. Kello, Radford, Va.

PANTHER.—This company is building a narrow gage lumber railway seven miles in length up Panther Creek. About three miles are graded, and tracklaying will probably be commenced next week. The line is eventually be extended 15 or 20 miles. Engr., W. B. Hooker, Panther, McDowell county, W. Va.

TENNESSEE CENTRAL.—Robt. L. Morris, Secy., Nashville, Tenn., writes us that this railway, as at present projected, begins at Monterey, Putnam county, the terminus of the Nashville & Knoxville, and runs by way of Crossville, Rockwood, Harriman, and Kingston, Tenn., to Knoxville. The road has been graded as far as Crossville. The remainder of the grade is under contract with different contractors, Thos. McFarland, A. Tubman, and C. F. Newton being the principal contractors. It is expected that tracklaying will be begun within the next 60 days, and that the road will be in operation from Monterey to Kingston within the next eight or nine months.

VIRGINIA, FREDERICKSBURG & WESTERN.—Public meetings are being held at Fredericksburg and other cities to secure aid for the construction of this railway, recently noted in these columns. It is stated that $1,485,000 of stock has already been subscribed. Ch. Engr., Wm. A. Hankins, Fredericksburg, Va.

Northwest.

BRAINERD & NORTHERN MINNESOTA.—Press reports from Brainerd, Minn., state that surveys have been commenced for a 20-mile extension of the main line north from Lothrop, Minn., and it is also proposed to build this year three or four branches aggregating from 20 to 30 miles. The work will be done by the company. Ch. Engr. and Gen. Supt., F. W. Kimball, Minneapolis, Minn.

CHICAGO & OLD COLONY.—Incorporated in Wisconsin to construct 800 miles of railway in Wisconsin, from Madison to Sturgeon Bay, some point on the southern state line in Kenosha county, to Superior, and from Green Bay to La Crosse; capital stock, $15,000,000; incorporators, Charles D. Smith, M. G. Smith, and Milan W. Smith, of Fond du Lac, Wis.; John S. McClure and Albert Heiman, of Chicago.

DULUTH & WINNIPEG.—Press reports claim that this railway will be extended from its present terminus at Deer River, Minn., to St. Vincent, on the Canadian Pacific, and that Donald Grant, of Faribault, Minn., and an Eastern contractor have been at Montreal for several days figuring with Wm. C. Van Horne, Pres., Canadian Pacific, on contracts for the construction, which is to be commenced in May. W. F. Fitch Duluth, is receiver and general manager of the Duluth & Winnipeg.

Southwest.

CHESTER, FARMINGTON & WESTERN.—Incorporated in Missouri April 18 to build a railway from Perry county, on the Mississippi River, opposite Chester, Ill., through the counties of St. Genevieve, St. Francois and Washington, to a junction in the latter county with the St. Louis, Iron Mountain & Southern at Irondale, Mo.; capital stock, $500,000, with $25,000 paid in; incorporators, A. H. Hester, Chicago, Ill.; A. J. Cooper, Chicago, Ill.; Leon Bogy, St. Mary's, Mo.; Frank Butterworth, New York; Warwick Hough, St. Louis, and others.

DENISON & NORTHERN.—It is stated at Denison, Tex., that a contract has been closed for the construction of this railway. The road is projected from Denison to Coffeyville, Kan., and the charter of this company would become void unless 50 miles of the road are built before Aug. 11, 1895. The charter is said to be one of the most valuable ever granted by congress.

HUTCHINSON & SOUTHERN.—Press reports quote H. A. Christy, Pres. and Gen. Man., Chicago, as stating that the construction will be commenced within 60 days on an extension of this road from its southern terminus at Cameron, Kan., south through Oklahoma and into Texas.

JONESBORO & EASTERN.—Incorporated in Arkansas April 18 to build a railway and toll bridge from near Jonesboro to the St. Francis River, 18 miles; capital stock, $145,000; incorporators, A. C. Broadaway, J. H. Mangrum, N. F. Lamb, Wm. Collins and Emily Lamb.

KANSAS CITY, WALKINS & GULF.—A press report from Alexandria, La., states that Prof. P. H. Philbrick, Ch. Engr., returned to that city April 16 from his survey of the proposed line from there to Natchez, Miss. He left at once for Lake Charles. He said that the line shows up fully as well as was expected; that the construction of the drawbridge on Black River, the only navigable stream on the route, was very feasible, and better than he contemplated; that they will build a practically straight line of about 63 miles, with an easy grade.

OKLAHOMA, ROSWELL & SOUTHWESTERN.—This company is reported to have been organized to build a railway from El Paso to Washburn, Tex., by way of Roswell, N. Mex.; capital stock, $500,000; Pres., E. F. H. Lewis, Eagle Pass., Tex.; Vice-Pres. and Gen. Man., O. M. Garber, Portland, Ind.; Secy. and Treas., A. S. Dowler, Chicago; principal office, Roswell, N. Mex.

PARIS, HEARNE & GULF LINE.—A press report from San Antonio, Tex., states that H. K. Davis, a banker of Hearne, Tex., announces that he has completed the necessary financial arrangements with New York capitalists for the construction of a railway from Paris to Galveston, via Hearne and Velasco, a distance of 481 miles. The road will be called the Paris, Hearne & Gulf Line. Mr. Davis will be the president of the company, and S. S. Massey, of San Antonio, will be the manager of the construction department. Application for a charter for the company will be made in a few days, and the surveying party will be placed in the field May 1.

PECOS VALLEY.—The El Pasos, Tex., "Times" states that an engineering corps is now in the field locating the line from Roswell, N. Mex., to Washburn, where the Pecos Valley road will connect with the Santa Fe, the Chicago, Rock Island & Pacific, and the

Fort Worth & Denver City. It is well known that Mr. Hagerman has his eyes on El Paso, and it is true that an engineering corps is also in the field between Roswell and El Paso. The Pecos Valley, with a line into El Paso, would form a through line to Kansas City and Chicago and shorten the distance nearly 300 miles.

ST. LOUIS SOUTHWESTERN.—Jas. J. Moore, Pres. Central City Trust Co., Waco, Tex., writes us that efforts are being made to secure an extension of this railway from its present terminus at Gatesville, Tex., to Brownwood, a distance of about 85 miles. This would give this road a direct line to the recently found coal mines in Coleman county, Tex., would give a direct line from Waco to the coal fields, and would cheapen coal at least 50%, which is an end much to be desired by Waco, as this city is doing all in its power to build up manufacturing plants, and all the obstacles have been overcome but the one of cheap fuel. This will now soon be overcome.

Rocky Mt. and Pacific

COOS BAY TRANSPORTATION CO.—Incorporated in Oregon to construct a railway from Isthmus slough, Coos county, to Catching slough; also from the mouth of Big Creek, in the same county, north to a point west of Willamette meridian, in same county; also from a point on the south fork of Coos River to the north fork of Coquile River; principal place of business, Marshfield, Ore.; capital stock, $50,000; incorporators, E. B. Dean, E. W. Dean and P. L. Phelan.

OREGON CENTRAL & EASTERN.—Incorporated in Oregon to construct or purchase railways, telegraph and telephone lines from Yaquina Bay to the eastern boundary of the state, thence to Boise City, and also branch lines, one leaving the main line at Corvallis and terminating at Eugene, the other branching at or near Albany and terminating at Salem; capital stock, $300,000; principal office at Corvallis, Ore.; incorporators, A. B. Hammond, Edwin Stone and Charles Clark. This is a reorganization of the Oregon Pacific, which will probably be extended in the near future.

UNION PACIFIC, DENVER & GULF.—F. Trumbull, Receiver, Denver, Colo., is reported to have sold $300,000 of receiver's certificates for the construction of a line to secure independent trackage between Pueblo and Trinidad, Colo., and it is stated that the construction will be pushed as rapidly as possible.

WEISER & IDAHO NORTHERN.—Leonidas Merritt, Pres., Duluth, Minn., writes us that surveys have been made, rights of way secured, capital for the construction guaranteed and that contracts will be awarded at an early date for building this railway from Weiser, Idaho, into the Seven Devils mining district, 102 miles. Ch. Engr., E. H. Mix, Weiser, Idaho.

Foreign.

HIDALGO & NORTHEASTERN.—A press report from Tampico, Mex., states that the arrangements for the building of the extension of the Hidalgo railway from Pachuca to Tuxpan, a distance of 120 miles, have been completed, and that the work of construction will begin immediately, the final survey for the line having been completed and approved by the Federal Government some time ago. Ch. Engr., Antonio Caso, Mexico, Mex.

INTER OCEANIC.—A press report from the city of Mexico, Mex., states as follows: Don DeLan Sanchez, the Inter-oceanic Ry. contractor, has left on a flying trip to London on business in connection with the construction of his road to the Pacific coast. J. H. Kain, formerly chief engineer of the Mexican Central, has everything ready for starting the construction of the 20 kilometers of the Inter-oceanic already contracted for from Chitla, the present terminus of the road, to Zacualpitan and to the west. Surveys and maps for submission to the government are being prepared looking to the building of 60 kilometers more from Zacualpitan toward the coast when the present extension is finished. From appearances the Inter-oceanic will beat its rival, the Mexico, Cuernavaca & Pacific, in the race to the west coast of Mexico. Although an additional extension on the Cuernavaca line has been ordered the ultimate destinations of the two roads are not definitely known, but Acapulco is generally thought to be the best terminus for both lines, and it is assured that it will obtain at least one of the roads.

MEXICO, CUERNAVACA & PACIFIC.—Press reports state that the construction of this railway has been resumed, and that the road will be in operation between the city of Mexico and Cuernavaca in a few weeks. Pres. and Gen. Man., J. H. Hampson, Mexico, Mex., and Kansas City, Mo.

STREET AND ELECTRIC RAILWAYS.

BELFAST, ME.—James Mitchell, of Union, Me., is reported as interested in a project for an electric railway between Searsport and Northport, by way of Belfast, according to reports.

CHESTER, N. H.—Plans are being discussed for the construction of the Derry & Chester Electric R. R. G. S. West, A. P. Morse and O. F. Page are interested.

BRAINTREE, MASS.—Geo. A. Beatey has petitioned for a franchise for an electric railway from South Braintree to the Randolph line.

COTTAGE CITY, MASS.—The Cottage City St. Ry. has been sold to the Boston & Quincy R. R. Co. It is reported that the road will be equipped with electricity at once, and probably be extended to Vineyard Haven. Supt., E. G. Eldridge.

SOUTH BRAINTREE, MASS.—It is reported that the Braintree, Randolph & Holbrook St. Ry. Co. has voted to purchase additional machinery for its power house.

BRISTOL, CONN.—Bids are asked for materials for constructing an electric railway eight miles in length. Address Fred T. Ley & Co., Gridley House.

ALBANY, N. Y.—Plans have been approved by the Albany Ry. Co. for the extension of its power house, so as to contain a new 1,000-HP. boiler and generator. Ch. Engr., T. E. Murray.

BATH, N. Y.—It is reported that there is talk of an electric railway from Hornellsville, by way of Harvard, Bath and Urbana, along the west side of Lake Keuka to Penn Yan. The project includes a plant in this city for power and lighting.

NEW YORK, N. Y.—The Broadway & Seventh Ave. R. R. Co. has filed a certificate for the extension of its road on a number of streets.——The New York, Westchester & Connecticut Traction Co. has filed a certificate for the extension of its road in Port Chester.

BROOKLYN, N. Y.—The Nassau Electric Ry. Co. has been granted permission to complete its road on Marcy Ave.

HOBOKEN, N. J.—The North Hudson County Ry. Co. has petitioned for permission to extend its electric road on Fourth St.

BEAVER FALLS, PA.—It is reported that the Beaver Valley Traction Co. is about to begin the construction of a two-mile extension to its electric road, at an estimated cost of $25,000.

COLUMBIA, PA.—Edward N. Smith is making surveys for an electric railway to Mount Joy.

UPLAND, PA.—The council has granted franchises to the People's Ry. Co. and the Media, Middletown & Aston Ry. Co. Joseph R. T. Coates, of Chester, is interested in the former company, and S. A. Price in the latter.

PITTSBURG, PA.—The Monongahela Traction Co. has applied for a franchise for an electric road between Pittsburg and Greensburg.

ATLANTA, GA.—R. D. Fisher, Elias Harman and F. J. Stone have applied for a franchise for an electric railway.

BRUNSWICK, GA.—The St. Simons Transit Co. has been organized with a capital stock of $20,000; Pres., A. H. Lane; Secy. and Treas., W. F. Parker; Supt., U. Dart.

JACKSONVILLE, FLA.—The Jacksonville & Tampa Bay Ry. Co. has applied for a charter for an electric railway, about 50 miles in length, from Jacksonville to Tampa, by way of Palatka, Sanford and Kissimmee, with a branch from Kissimmee to Fort Myers; capital stock, $2,000,000; incorporators, C. C. Thompson, Martin Dodge and T. S. Appleyard, Secy. State Senate.

BILOXI, MISS.—The Pass Christian, Mississippi City, Handsboro & Biloxi Electric Ry. Co. has been incorporated to build an electric railway. Pres., L. B. Moseley; Vice-Pres., W. L. Dinkins; Treas., C. Phelps.

BUCYRUS, O.—The Inland Electric Ry. Co. has petitioned for a franchise for a road between this place and Sulphur Springs, a distance of seven miles. Pres., M. J. Monnett.

WADSWORTH, O.—The Wadsworth Electric Ry. Co. has been incorporated to build an electric railway between this place, Cleveland, Akron and Wooster; capital stock, $10,000; incorporators, F. G. McCauley, J. S. Oberholtzer, W. A. Ault, R. F. Weaver, W. S. Holloway and O. V. Dibble.

NEW ALBANY, IND.—It is reported the Pittsburg, Cincinnati, Chicago & St. Louis Ry. Co. is about to equip its road between this city and Jeffersonville, a distance of two miles, with electricity.

DENISON, TEX.—Bids are asked for one 500-volt generator and three 16-ft. cars with a single electrical equipment of 25 HP. each, or a double equipment of 15 HP. George McLagan, Secy. Denison St. & Electric Ry. Co., recently incorporated, with a capital stock of $50,000, by G. L. Blackford and others.

OTTAWA, ONT.—Press reports state that an application will be made to parliament next session for the incorporation of the International Radial Ry. Co., which proposes to build electric railway lines in various parts of Western Ontario, to operate barges and steamships between terminal points of the railway on lakes Erie and Ontario and ports of the United States; to acquire or enter into other arrangements with electric railways now in operation, and with the Canadian Pacific Ry. Co., and the Canada Southern Ry. Co., or New York Central Ry. Co., and to build works to generate electricity for heat, light, power and other purposes, and to distribute the same.

WINDSOR, ONT.—A company has been organized to build a street railway to Bar Point, a distance of 1½ miles, with a capital stock of $100,000, by E. W. Voigt, John Atkinson, James Randall, of Detroit; William McGregor, of Windsor; W. D. Balfour and Thomas Ouellette, of Essex county. It is intended eventually to extend the road to Harrow, Kingsville and Leamington.

ELECTRIC LIGHT AND POWER.

BARTON, VT.—It is reported that the committee has purchased water power to operate a municipal electric light plant.

TRUMANSBURG, N. Y.—The construction of an electric light plant is being discussed.

WAPPINGERS FALLS, N. Y.—J. W. Hinckley is said to be interested in a project to put in an electric light plant for this place, power to be furnished from Poughkeepsie.

HOBOKEN, N. J.—The county board has awarded the contract for an electric light plant and lighting the new county road to M. T. Connolly, at $78,900. The contract was awarded to the Complete Electric Light Co., but was rescinded.

TAMAQUA, PA.—Bids are asked for constructing an electric light plant of 80 to 100 arc lights. Address William Conrad.

ENTERPRISE, MISS.—S. H. Gelheman, of Springfield, Ill., and L. R. Bradley, have applied for a franchise for an electric light plant.

CLEVELAND, TENN.—It is reported that contracts have been awarded for an electric light plant and water-works system.

RUSHVILLE, IND.—M. L. Howe, of Indianapolis, has offered to construct an electric light plant and water-works system for $70,000, the city to take four-fifths of the capital stock.

PORT HURON, MICH.—It is reported that the council has voted to advertise for bids for 100 to 150 electric lights. F. F. Rogers, Cy. Engr.

SOUTH HAVEN, MICH.—The citizens voted April 15 to issue $10,000 in bonds for a municipal electric light plant, to be completed by July.

ROCK FALLS, ILL.—P. H. Davis writes us that at an election April 16 it was voted to construct an electric light plant this summer, to cost probably $10,000.

FULLERTON, NEB.—There is talk of putting in an electric light plant.

TAYLOR, TEX.—The Taylor Electric Light & Power Co. has been reorganized. It is reported that a number of improvements are to be made to the plant.

PORTLAND, ORE.—It is reported that Henry Cram is about to put in an electric plant to furnish power for pumping water for irrigating his orchard at Penawawa, on Snake River.

COLTON, CAL.—The construction of a municipal electric light plant, to furnish 1,000 incandescent lights, estimated to cost $5,000, is being considered, according to reports.

SANTA ANA, CAL.—Press reports state that arrangements have been made between the Santa Ana Gas Co. and the Olive Milling Co., by which the latter company is to furnish the former with water power at Olive, ten miles distant, for dynamos to generate electricity for Santa Ana. The water used for power is from the irrigating canal. It comes from the mouth of Santa Ana canyon and falls into the valley. The company claims that the city can now be lighted at less than half the previous cost.

LISTOWEL, ONT.—Bids are asked until May 1 for lighting this place with electricity.

VANCOUVER, B. C.—Bids are asked until June 1 for lighting the city with electricity. T. F. McGuigan, Cy. Clk.

NEW COMPANIES.—Delaware County Electric Co., Chester, Pa.; $1,000, with $100 paid in; Treas., Wm. S. McManus, Thurlow, Pa.

Milwaukee Incandescent Lamp Co., Milwaukee, Wis.; $9,000; J. J. Reilly, W. J. Reilly, Barney Davis.

Rawson Light & Power Co., Leicester, Mass.; $25,000; to conduct the business of the Leicester Electric Co.; Pres., E. L. Watson; Treas., Walter C. Watson.

Felts Primary Battery Co., Sacramento, Cal.; $1,000,000, with full amount paid in; W. W. Felts, R. Watkins, G. W. Merrell, Sacramento; W. F. Ford, Colusa; E. E. Scott, Maxwell.

Asbury Park Electric Co., Asbury Park, N. J.; $2,000,000, with $100,000 paid in, to operate in the towns of Asbury Park, Bradley Beach, Neptune City, Belmar, North Spring Lake; Geo. A. Smock, James M. Ralston, John W. Rockefeller, Nelson E. Buchannan, Jacob A. W. Hetrick, Bruce S. Keator, of Asbury Park; A. A. Taylor, Bradley Beach.

BRIDGES.

HOULTON, ME.—The Berlin Iron Bridge Co., of East Berlin, Conn., has been awarded a contract for an iron and steel bridge across the Meduxnekeag River at about $10,000.

LITCHFIELD, N. H.—It is reported that a bridge is to be built across the Merrimac River at this place.

GREENFIELD, MASS.—Plans and estimates for a new bridge across Green River at Newton Place are to be prepared, and a town meeting is to be held to discuss the subject. A. H. Wright and Lyman G. Barton are interested.——The Greenfield & Turner's Falls Electric Ry. Co. has petitioned the legislature for permission to build a bridge across the Connecticut River.

NEW HARTFORD, CONN.—Press reports state that it is authoritatively stated that the judiciary committee of the legislature will report in favor of transferring the Hartford bridge from the state to the towns of Hartford and East Hartford. The committee, it is said, will also declare the contract with the Berlin Bridge Co. for a new structure to cost more than $300,000 invalid, because it provides for a bridge unlike the old one.

BUFFALO, N. Y.—Bids are asked until May 7 for constructing a new iron superstructure for a bridge on Michigan St., over Buffalo River. R. G. Parsons, Secy. Dept. Pub. Wks.

CALLICOON DEPOT, N. Y.—The construction of a bridge across the Delaware River, estimated to cost $30,000, is being discussed. It has been decided to award the contract as soon as $15,000 has been subscribed. C. A. Thorwelle, Thomas Pendell, S. E. Wenzel and others have been appointed a committee.

COLDEN, N. Y.—It is reported that a $4,000 bridge will be erected to take the place of an old wooden one at this place.

LITTLE FALLS, N. Y.—The legislature has passed a bill providing for a bridge over the canal at German St.

NEW YORK, N. Y.—It is reported that a bridge contract for three through pin-connected spans, 158 ft. long each, and two deck-plate girder spans, 60 ft. long each, has been awarded to the Edge Moor Bridge Works by the Lake Erie & Western R. R. Co.

OGDENSBURG, N. Y.—We are informed that the Hilton Bridge Construction Co. has been awarded the contract for building the 220-ft. plate girder bridge at this place, at $39,000. The bids were published last week.

SYRACUSE, N. Y.—The governor has signed the bill appropriating $10,000 for a bridge over the canal at Genesee St.

WEST CHESTER, N. Y.—It is reported that an iron bridge 40 ft. wide, estimated to cost $25,000, will be constructed over West Chester Creek at Main St., the work to begin in May.

McKEESPORT, PA.—The construction of a bridge at Fifth Ave. is being considered.

PITTSBURG, PA.—Plans have been prepared for a 620-ft. bridge to span Panther Hollow, in Schenley Park. The main span is to be of steel, and will be 300 ft. in length. It is reported that bids will soon be asked for the construction. E. M. Bigelow, Dir. Dept. Pub. Wks.

GADSDEN, ALA.—It is reported that an election will be held in Cneasakee county in August to vote on the question of issuing $20,000 in bonds for a bridge near Cedar Bluff.

OWENSBORO, KY.—It is reported Judge Karn is prepared to receive bids for the construction of a 165-ft. bridge over Panther Creek at Curdsville. W. T. Washer, of Troy, Ind.; H. T. and H. F. Sinnott, representing the Youngstown Bridge Co., made the surveys.

ASHTABULA, O.—The county commissioners are

making arrangements for the construction of the high level bridge at Spring St., for which the citizens recently voted to issue $25,000 in bonds. The bridge is estimated to cost $67,000. It is reported that bids will soon be asked for the construction.

CINCINNATI, O.—The following bids were received April 16 for the viaduct superstructure on West Eighth St., over Boldface Road, as advertised in Engineering News; the itemized bids for the substructure are given under Contract Prices:

Pennsylvania Steel Co., Steelton, Pa.	$37,988
Wisconsin Bridge & Iron Co., Milwaukee, Wis.	41,700
American Bridge Works, Chicago, Ill.	41,2 0
King Bridge Co., Cleveland, O.	46,30
Shiffler Bridge Co., Pittsburg, Pa.	42,670
Indiana Bridge Co., Muncie, Ind.	44,355
Pennsylvania Bridge Co., Beaver Falls, Pa.	46,000
Edge Moor Bridge Works, Wilmington, Del.	44,890
New Columbus Bridge Co., Columbus, O.	45,500
Massillon Bridge Co., Toledo, O.	43,000
Lafayette Bridge Co., Lafayette, Ind.	46,100
Variety Iron Works Co., Cleveland, O.	42,881
F. J. Meyers Mfg. Co., Hamilton, O.	46,995
Toledo Bridge Co., Toledo, O.	44,863
L. Schreiber Sons Co., Cincinnati, O.	41,9 8
Groton Bridge & Mfg. Co., Groton, N. Y.	45,500
Youngstown Bridge Co., Youngstown, O.	45,940
Keeper, Wynkoop & Thatcher, Detroit, Mich.	44,317
The Bracket Bridge Co., Cincinnati, O.	43,500
Wrought Iron Bridge Co., Canton, O.	46,500
Cincinnati Architectural Iron Works Co.	39,798
Canton Bridge Co., Canton, O.	53,000

INDIANAPOLIS, IND.—The American Bridge Works, of Chicago, was awarded the contract for building the Raymond St. bridge over Pleasant Run, at $2,631. The bids were published last week under Contract Prices.

GRAND RAPIDS, MICH.—The Plainfield Ave. Gravel Road Co. has been directed by the court to rebuild its bridge across the river, which will probably cost about $8,000.

KALAMAZOO, MICH.—It is proposed to build an iron bridge across the river at Mills St., estimated to cost $6,000. It is reported that new bridges will also be built across the creek at Orcutt and Main Sts.

KEYESPORT, ILL.—The Jacksonville, Louisville & St. Louis Ry. Co. has awarded the contract for a steel bridge to span the Okaw River at this place to the Edge Moor Bridge Works, of Wilmington, Del., and that for the masonry to the Culver Stone Co., of Springfield, Ill. Gen. Man., C. M. Stanton, Jacksonville, Ill.

ROCK ISLAND, ILL.—The government has ordered the city to build a draw in the bridge across the Rock River, at an estimated cost of $10,000. Capt. W. L. Marshall, of Chicago, is considering a suggestion from the city for raising the bridge from its present height of 11 ft. 8 ins. to 40 ft. above water level, at an estimated cost of $6,000.

DES MOINES, IA.—The Iowa Brick Co. is reported about to petition the council to build a 400-ft. bridge across the river near its brick plant, at an estimated cost of $20,000.

SIOUX CITY, IA.—The Iowa & Nebraska Pontoon Bridge Co. is reported about to engage J. A. L. Waddell, of Kansas City, as engineer of its proposed $700,000 highway bridge.

LEAVENWORTH, KAN.—Bids are asked until May 11 for building three iron bridges in this county. J. W. Niehaus, County Clk.

TOPEKA, KAN.—It is reported that an election will soon be held to vote on the question of issuing $160,000 in bonds for a bridge on Kansas Ave., in this city.

GENEVA, NEB.—H. T. Ward & Co., of Tecumseh, have been awarded the contract for building an iron bridge north of the city, and also for all the wood bridges to be built this season.

BATESVILLE, ARK.—Plans will soon be prepared, according to reports, for four new bridges in Independence county. J. B. Pritchett, Bridge Comr.; John Pascoe, Road Comr.

DENVER, COLO.—E. P. Martin, Ch. Engr., informs us that the following bids have been received for taking down the old iron bridge across Cherry Creek at Broadway and re-erecting it upon cylinder foundations:

*The Bullen Bridge & Const'n Co., Pueblo, Colo.	$6,766
Wrought Iron Bridge Co., Canton, O.	6,931
Gaffey & Grant, Denver, Colo.	7,858
Buckingham & Estes, Denver, Colo.	8,087
Youngstown Bridge Co., Youngstown, O.	8,423

* Awarded contract.

RIVERSIDE, CAL.—It is reported that bids are being received for the construction of a bridge in San Timeto canyon, and that the supervisors will award the contract in May.

FREDERICTON, N. B.—Press reports state that the ice jam in the St. John River has seriously damaged one of the piers of the railway bridge. The entire pier was moved down the river about 4 ft., and the top badly twisted, entirely interrupting traffic. It may not be repaired until low water in midsummer. The bridge is more than half a mile long.

BUILDINGS.

PROVIDENCE, R. I.—Bids are asked until May 3 for constructing a building for the state normal school on State St. Archs., Martin & Hall, Industrial Trust Co. Bldg.; Secy., Thomas B. Stockwell.

BUFFALO, N. Y.—The Lafayette St. Church Society has obtained a permit to build its $100,000 church at Bouck and Elmwood Aves.; Archs., Sansing & Beierl.——The board of public works is about to advertise for competition plans for the new East Side high school building, which will cost $150,000. The architect whose plans are selected will get the work, the next four receiving $100 each.

NEW YORK, N. Y.—Plans have been filed by Columbia College for 4-story brick building on 49th St., to cost $100,000; East River Savings Institution, 4-story brick bank building at 3 Chambers St., to cost $100,000; Manhattan & Merchants' National Bank, 40 Wall St., alterations to 9-story bank building, to cost $200,000; Nettie A. Gerlach, 49-53 West 23d St., alterations to 10-story brick hotel, to cost $150,000; Clarence L. Smith, 542 West 28th St., 9-story brick store, at 43½-51 Lispenard St., to cost $100,000, and Church of St. Ignatius Loyola, alterations to 1-story church at 84th St. and Park Ave., to cost $200,000.

YONKERS, N. Y.—E. A. Quick & Son have prepared plans for a new city hall, estimated to cost $100,000.

PITTSBURG, PA.—Geo. B. Post, of New York, is preparing plans for a 15-story office building on Fifth Ave., estimated to cost $600,000 to $700,000. David E. and Wm. G. Park are interested.——A hotel, estimated to cost $900,000, is to be built on Fifth Ave., work on which will begin June 1. M. I. Baird is interested.——A combined 2-story storage and grain elevator building is to be erected on the south side by the Henderson-Johnson Co. The elevator will have a capacity of 500 cars or 500,000 bales, and is estimated to cost $30,000. Engr., C. D. Sword.

BALTIMORE, MD.—It is reported that the White & Middleton Gas Engine Co. is about to award the contract for the construction of a new 210 × 80-ft. factory building at Winders and Charles Sts.

WASHINGTON, D. C.—Bids are asked until May 18 for the construction of two stone buildings, etc., at Santa Fe, N. Mex., national cemetery. Maj. C. R. Barnett, Depot Q. M., U. S. A.

ATLANTA, GA.—Bids are asked until May 2 for erecting the buildings for the Mexican Village at Piedmont Park. A. H. Smythe, Secy., Columbus, O.; Arch., J. B. Legg, St. Louis, Mo.; Grant Wilkins, Atlanta.

NEWPORT, KY.—Bids are asked until May 10 for constructing a drill hall at Fort Thomas, Ky. Lieut. R. D. Turner, A. A. Q. M., U. S. A.

CLEVELAND, O.—Bids are asked until May 11 for erecting an 18-room school building as an annex to the Cherry school on Cherry St., and until May 18 for remodeling and rebuilding the Hicks school building. H. J. Sargent, School Dir., Bd. of Education.——It is reported that work will soon begin on a new chamber of commerce building, estimated to cost from $300,000 to $500,000. Pres., Wilson M. Day.

TOLEDO, O.—Bids are asked until May 16 for the construction of an industrial school building. Arch., E. O. Fallis, Nasby Bldg. H. A. Tobey, Secy. Bd. Toledo State Hospital.

BRAZIL, IND.—Bids are asked until May 28 for the construction of a county jail. J. J. Huffman, Chn. Comrs. Thos. Phillips, County Audr.

GRAND RAPIDS, WIS.—Bids are asked by the committee until May 2 for constructing a county jail. Archs., H. C. Koch & Co., Milwaukee. Geo. L. Williams, Chn. Com.

ST. PAUL, MINN.—Plans are asked until Aug. 5 for a new capitol building, the cost not to exceed $1,500,000. Four premiums will be awarded to the designs adjudged to stand, in point of merit, second, third, fourth, and fifth, as follows: To the 2d, $1,000; to the 3d, $800; to the 4th, $700; to the 5th, $500. The accepted design will receive no other premium than the fee allowed by the board for designing and superintending the construction of the building, which will be, on the first $500,000 of cost, 5%; on the second $500,000 of cost, 4%; on the remainder of the cost of the building, 2%, and on the completion of the building, provided the architect shall have kept the cost of the building within the sum limited by law, the further sum of $5,000. Channing Seabury, Vice-Pres. Bd. State Capitol, Conn.

WATER-WORKS.

WARNER, N. H.—The village fire precinct has voted to issue $6,000 in bonds for works. M. T. Ela, W. C. Johnson and A. P. Davis are members of the committee.

MEDFORD, MASS.—The council has appropriated $46,000 for extensions.

WORCESTER, MASS.—The council has authorized the city treasurer to make a 30-year loan of $50,000 for water-works construction, and has voted to petition the legislature for authority to issue bonds for a new storage reservoir.

AKRON, N. Y.—V. M. Roberts, of the Tonawanda Engineering Co., is reported as trying to interest the residents of this village in works.

ALBANY, N. Y.—B. Lodge and others are advocating the altering of the intake and the laying of a new intake pipe.

BALLSTON SPA, N. Y.—Harvey M. Geer has been directed to prepare plans and estimates for extending the works.

BROOKLYN, N. Y.—Bids are asked until May 21 for furnishing and erecting pumping engines, boilers, etc., for a daily supply of 60,000,000 gallons of water (postponement of date from May 9). A. T. White, Comr. Cy. Wks.

KINGSTON, N. Y.—The council is reported to have abandoned negotiations with the water company, and to have voted to petition for permission to issue $500,000 in bonds for new works.

LOWVILLE, N. Y.—A special election will be held soon to vote on an additional appropriation of $5,000 for a storage reservoir.

MONTGOMERY, N. Y.—Alexander Potter, of New York, has been engaged to prepare plans and specifications, and to superintend the construction of works, estimated to cost $30,000. Advertisements for the construction will probably be published in about three weeks. Chauncey Brooks, Chn. Com.

PHILMONT, N. Y.—There is talk of constructing works, according to reports.

SCHENECTADY, N. Y.—Bids are asked until May 9 for the construction of a steel stand-pipe, as stated in our advertising columns. Geo. T. Bradt, Secy. Comrs.

SYRACUSE, N. Y.—Bids are asked until May 6 for about 9,260 tons of straight cast iron pipe and about 645,000 lbs. of special castings, as stated in our advertising columns. Ch. Engr., W. R. Hill; Secy., J. B. Brooks.

YONKERS, N. Y.—Bids are asked until May 2 for 295 tons of 12 to 4-in. pipe, also for two horizontal tubular boilers. J. R. Lockwood, Secy. Comrs.

BAYONNE, N. J.—The New York & New Jersey Water Co. was incorporated April 19 to operate in Hudson, Morris, Essex, Bergen and Union counties, N. J., and in New York, Kings, Queens, Westchester and Richmond counties, N. Y.; capital stock, $1,000,000, with $1,000 paid in; incorporators, Chas. E. Clarke, Montclair, N. J.; Anson A. Gard, Yonkers, N. Y.; Edward Phillipps, Brooklyn; John W. Colwell, N. Y., and Philetas H. Maison, Rutherford, N. J.

JERSEY CITY, N. J.—The bids recently received for a water supply have been rejected, and new bids will be considered April 27, as noted at length in our editorial columns.

DANVILLE, PA.—The water commissioners have contracted with the Morison-Jewell Filtration Co., of New York, for the immediate construction of a 1,500,000-gallon gravity filter plant.

EAST BRADY, PA.—The East Brady Water-Works Co. has been incorporated with a capital stock of $5,000, commencing with $500; Treas., J. W. Bennett.

HOMESTEAD, PA.—Bids are asked until May 4 for a supply of cast iron pipe. T. H. Williamson, City Com.

MECHANICSBURG, PA.—The Silver Spring Water Co. has been incorporated with a capital stock of $5,000, commencing with $500; principal office at Harrisburg; Treas., J. Schinneller, Pittsburg, Pa.

MINERSVILLE, PA.—Charles R. Kear, Man., writes us that the Minersville Water Co. will not award contracts, but will construct the additional reservoir by day labor.

NEW HOLLAND, PA.—H. K. Storb, Secy. New Holland Water Co., writes us that W. H. Allen, of Downington, Pa., is preparing specifications for works which will include about four miles of 8 or 10-in. pipe. The supply will be from springs having an elevation of 140 ft. above the town, and so situated that a dam is all that will be required for a reservoir to hold 300,000 gallons. Pres., A. W. Snader.

NICHOLSON, PA.—F. P. Stephens, Clk., writes us that there is some talk of issuing bonds to purchase works or construct new works, but that no definite action has yet been taken.

FARNHURST, DEL.—Bids are asked for sinking a well to secure a guaranteed supply of not less than 40 gallons per minute. David M. Coy, Supt. Trustees of County Poor.

HYATTSVILLE, MD.—E. L. Latimer, Secy. Citizens' Improvement Association, has been directed to correspond with parties and ascertain which will consent to visit the town free of cost and recommend a location for establishing works.

SNOW HILL, MD.—J. R. Moreland, of Wilmington, Del., assisted by M. M. Gillett, of New York, are reported as making plans for works to cost about $18,000.

WAYNESBORO, VA.—It is stated that works will soon be constructed. Address W. J. Loth.

KEY WEST, FLA.—A bill has been introduced in the legislature authorizing this city to issue $100,000 in bonds for works, etc.

THOMASVILLE, GA.—The council is reported as in favor of issuing $150,000 in bonds for extending and improving the works. E. O. Thompson, Supt.

GADSDEN, ALA.—It is stated that the construction of a 5,000,000-gallon reservoir will be commenced this week.

SCRANTON, MISS.—Bids are asked until May 7 for constructing works; supply from a 3-in. artesian well 780 ft. in depth; no plans yet prepared. S. R. Thompson, Comr.

OPELOUSAS, LA.—It is reported that this city will soon vote on the question of works and an electric light plant.

CLEVELAND, TENN.—The National Water-Works Co., of Pittsburg, Pa., has been granted a franchise for works and an elecric light plant, and it is reported that W. W. Cunningham, of Chattanooga, has been awarded the contract for constructing the plant.

MORRISTOWN, TENN.—Plans for works are being prepared by J. M. Ludlow, of Winston, N. C.

CELINA, O.—The following bids were received April 10 for the construction of the water-works system at this place; Engrs., Voorhees & Witmer, Buffalo, N. Y.:

Works, except pumps and boilers:

Boseker, Rantz & Co., Fort Wayne, Ind.	$37,097
Geo. W. Dudley & Co., St. Louis, Mo.	33,333
Snyder & Williams, Dayton, O.	33,066
Goodrich & Neal, Winchester, Ind.	32,400
Challenge Wind Mill Co., Batavia, Ill.	32,000
Kennedy & Darrow, Marietta, O.	32,593
Grimes & Moran, Elkhart, Ind.	33,246
Carothers & Crane, Newport, Ky. (aw'ded con.)	32,125
Geo. Cadogan Morgan, Chicago, Ill.	37,345
Karch Bros & Co., Celina, O.	33,542
L. C. Anderson & Co., Celina, O.	33,057
Hebert & Laperye, Chattanooga, Tenn.	33,417
Andrews & Marshfield, Indianapolis, Ind.	33,068
Branham, Gest & Co., Cincinnati, O.	32,747
Fairbanks, Morse & Co., St. Paul, Minn.	32,896

Pumps and boilers:

Laidlaw-Dunn-Gordon Co. (awarded contract)	$4,655
The John H. McGowan Co., Cincinnati, O.	4,750
Henry R. Worthington	5,225
Stillwell-Bierce & Smith-Vaile Co., Dayton, O.	4,692
The Deane Steam Pump Co., Holyoke, Mass.	5,650
The Buffalo Steam Pump Co., Buffalo, N. Y.	4,820
The Snow Steam Pump Co., Buffalo, N. Y.	5,578

HAMILTON, O.—J. R. Maxwell, of Cincinnati, has been engaged as consulting engineer for the proposed extensions. Bids were received April 19 from J. A. Wagner, of Dayton; the Wagner Water Supply Co., of Dayton, and from J. B. Yingling, of Chicago, for securing an additional water supply from wells.

WOOSTER, O.—P. F. Eason, Cy. Clk., writes us that no steps have yet been taken towards securing plans or awarding contracts for the proposed extensions. The city is now trying to find a water supply. If this is secured from wells a new pumping station will be required.

SHELBYVILLE, IND.—Frank Knuckles, Gen. Man., has been appointed receiver of the works at this place and Warsaw.

NEW ALBANY, IND.—The council has passed a resolution requiring the water company to have a system of filtration in operation within six months, and has appointed a committee to investigate the different systems.

RUSHVILLE, IND.—M. L. Howe, Indianapolis, is reported to have presented a petition to the council

offering to construct works and an electric light plant for $70,000, four-fifths of the capital stock to be taken by the city.

CROSWELL, MICH.—John W. Dexter, Village Clk., writes us that the village will construct a complete system of works; supply from river and wells; population, 1,000.

BAY CITY, MICH.—A bill has been introduced in the legislature authorizing this city to issue water-works bonds.

OXFORD, MICH.—The residents of this village have decided in favor of works by a vote of 235 to 67.

ASHLAND, ILL.—The water-works proposition was carried at the election April 16 by a vote of 125 to 101. W. F. Douglas, Clk.

CHICAGO, ILL.—Bids are asked until May 2 for 1,500 ferrules. W. D. Kent, Comr. Pub. Wks.

EARLVILLE, ILL.—At the election April 16 the citizens voted in favor of the water-works proposition.

ELMWOOD, ILL.—The citizens have voted to construct works estimated to cost $17,000.

GRAYVILLE, ILL.—The citizens voted April 16 to issue $30,000 in bonds for water-works and an electric light plant, to be owned by the city.——The Grayville Water-Works Co. was incorporated April 15, with a capital stock of $5,000, by Henry A. Gardner, L. Griffin and A. M. Morgan; principal office, Chicago.

LENA, ILL.—It is stated that this place will soon have works.

CEDAR RAPIDS, IA.—The superintendent writes us that the Cedar Rapids Water Co. will make extensions, including three miles of 20 to 6-in. pipe, and probably purchase a 3,000,000-gallon pump.

PORTSMOUTH, IA.—I. E. Houghton, Cy. Recorder, writes us that the proposed works will include 4-in. mains, 8 hydrants, a 2,000-bbl. tank and a windmill to pump the supply from a well. Bonds will be sold May 6; population, 310.

ARCADIA, WIS.—Steps are being taken to organize a local company to put in works and an electric light plant.

ASHLAND, WIS.—The citizens have organized an association to compel the water company to furnish pure water, and at lower rates. A suit has been begun to have the franchise declared void and a receiver appointed. J. T. Kingston and H. F. Higby are interested.

KAUKAUNA, WIS.—The council has granted a franchise to Wells, Reichert & Co., which calls for the construction of nine miles of pipe, with 90 hydrants, a pumping station, reservoir, stand-pipe, and a water supply from artesian wells, the work to be completed in seven months. The city is to lease the works for 20 years at $7,000 per year for the first four years, $9,000 per year for the next six years, and $10,000 per year for the last 10 years, at the end of which time the plant is to become the property of the city without further cost.

ELGIN, MINN.—The contract for works has been awarded to Fairbanks, Morse & Co., at $2,695.

SPRINGFIELD, NEB.—J. D. Quimby, Clk., writes us that an election will be held June 1, to vote on the question of works.

SALEM, S. DAK.—Bids are asked for the purchase of $1,200 in 7% city warrants, voted for the purpose of purchasing materials for extending the water mains. G. H. Randall, Mayor.

SHERIDAN, WYO.—Press reports state that the city has sold the remaining $40,000 of the $75,000 in bonds, voted over a year ago for works, and that the construction will be resumed at once.

DALLAS, TEX.—Bids are asked by the E. O. Standard Milling Co. for sinking an artesian well.

ITALY, TEX.—Bids are asked until May 1 for sinking an artesian well. Leon Levy, Secy.

SAN ANTONIO, TEX.—Bids are asked until May 8 for boring a well at Fort Ringgold, Tex. G. C. Smith, Ch. Q. M., U. S. A.

TEMPLE, TEX.—The water company is reported to have adopted the meter system, requiring each customer to purchase a meter at a cost of $17.53.

GRAND JUNCTION, COLO.—Bids will be received about June 1 for the construction of works estimated to cost about $200,000. The supply will be from the top of Grand Mesa, 24 miles distant, and having an elevation of 4,000 ft. above this city. The work will include 24 miles of 20 to 10-in. wooden pipe, about 10 miles of street mains, 75 hydrants, and a 6,000,000-gallon reservoir. The plans are being prepared by C. P. Allen, of the Denver Union Water Co., as consulting engineer. A. J. McCune is engineer in charge of construction.

ROCKY FORD, COLO.—Steps are being taken to sink an artesian well. It is thought that the first 500 ft. will cost $2 per ft., and it is stated that $800 has thus far been subscribed.

LAKE MEGANTIC, QUE.—A. B. Gendreau is building works at this place and wants information in regard to the cost of materials, etc.

IRRIGATION.

DIGHTON, KAN.—Bids are asked by the state board of irrigation until May 11 for constructing a pumping station, to consist of well, power, pump and reservoir, to be located within two miles of this city. Secy., Wm. B. Sutton, Russell.

BROWNWOOD, TEX.—It is reported that a company has been organized to build a reservoir on the Pecan River, which will irrigate about 40,000 acres of land.

ORANGE, CAL.—Press reports state that, at a cost of $5,000, the Santa Ana Valley Irrigation Co. has just cemented 3,000 ft. of its main canal. The ditch has a 10-ft. bottom and 5-ft. sides. Six hundred barrels of cement were used. As soon as the company can raise sufficient funds it will cement the remaining 22,000 ft. of ditch between the tunnels, about two and a half miles north of this place, and the head of the canal. The company is composed of landowners.

SAN BERNARDINO, CAL.—Press reports state that the Victor Reservoir Co. has sold its property to the Columbia Colonization Co., of Chicago. C. H. Howard, of "Farm, Field and Fireside," and his brother, Gen. O. O. Howard, are interested. It is said that the reservoir will contain when full 127,721,404,000 gallons of water, sufficient to irrigate 200,000 acres of land. The new company proposes to begin construction of a dam that will impound a lake of water nine miles long and five miles wide, and will be fed by the Mojave River.

PHOENIX, ARIZ.—Press reports state that a subcontract has been awarded to George & Touhey, under which the contractors are to put 75 teams and 100 men at work on the Agua Fria Canal. It is expected that the work will continue until the canal is completed, a distance of 30 miles. Four hundred feet of the diversion dam is now up to the 30-ft. level. The canal and dam can be completed by Sept. 1.

NEW COMPANIES.—Wallowa Irrigation Co., Wallowa, Ore.; $600; W. A. Story, John C. Handley, James A. Tulley.

SEWERAGE.

BROCKTON, MASS.—Bids are asked by the city treasurer until April 25 for the purchase of $175,000 of 4% sewer bonds.

EASTHAMPTON, MASS.—The town has voted to extend the system, as recommended by the commissioners.

JAMAICA PLAIN, MASS.—Bids were asked until April 30 for constructing 1,900 ft. of pipe sewers. Address Morton & Quimby, 53 State St., Boston.

MEDFORD, MASS.—Bids are asked until April 27 for constructing about six miles of sewers. John D. Street, Chn. Comrs.; Engr., T. H. Barnes.

SALEM, MASS.—Bids were opened April 22 for the purchase of $50,000 of 4% sewer bonds. F. A. Newell, Treas.

PROVIDENCE, R. I.—Bids were received April 22 for the purchase of $800,000 of 4% sewer bonds. D. L. D. Granger, Cy. Treas.

ALBION, N. Y.—At a meeting of taxpayers April 18 the proposition to construct a system of sewers was defeated by a large vote.

BROOKLYN, N. Y.—Bids are asked until May 6 for constructing section 2 of the main relief sewer extension in Greene Ave. A. T. White, Comr. Cy. Wks.——The taxpayers of the 28th ward have passed resolutions petitioning for the improvement of the system in that ward. Joseph Schiff, R. Stearn, Albert Palmey and Peter Grim have been appointed a committee to consider the matter.

BUFFALO, N. Y.—Bids are asked until May 7 for constructing 15 to 10-in. pipe sewers in three streets. R. G. Parsons, Secy. Dept. Pub. Wks.——Bids for constructing a 36, 33, 30 and 24-in. brick sewer in Roesch Ave., from Tonawanda St. to Skillen St., have been opened by the board of public works as follows: F. J. Koglin, $7,000; August Gisel, $7,777; Jacob Ritzman, $7,899; George W. Moore, $7,947; Thomas Dark & Son, $8,675; Christopher Smith, $8,775; Henry Kebbin, $8,935; William Franklin, $8,938; Elmer Mighton, $9,050; Fred J. Harter, $11,300.

HASTINGS-ON-HUDSON, N. Y.—Peter A. Hayes, Clk. Bd. Comrs., writes us the following bids were received April 18 for constructing a system, as advertised in Engineering News:

Henry M. Dowd & Co., Orange, N. J.	$14,400
Dougherty & Berrigan, Yonkers, N. Y.	20,946
Devery & Meyer, Hastings, N. Y.	21,333
Bellew & Merritt, Tuckahoe, N. Y.	21,570
Dinkel & Jewell, Irvington, N. Y.	21,900
Lee & Haley, Hastings, N. Y.	22,676
Troy Public Works Co., Troy, N. Y.	23,000

TONAWANDA, N. Y.—A bill is reported about to be introduced in the legislature for the construction of a system in the town of Kenmore.

ELIZABETH, N. J.—It is proposed to construct a sewer in Race and Pearl Sts.

WILLIAMSPORT, PA.—Bids are asked until May 9 for constructing 24 to 8-in. pipe sewers, as stated in our advertising columns. J. J. Galbraith, Cy. Clk.——The following bids were received April 18 for constructing sewers: A. H. Coon & Son, Kingston, $15,160 (awarded contract); Souder & Houston, Pittsburg, $18,092; Ward & Stocker, Harrisburg, $17,385; D. P. Guise, Williamsport, $17,973; James McCloud & Co., Williamsport, $18,524; Bowman Bros., McKeesport, $18,617; Hanna & Riley, Chester, $18,939; J. C. Schrade, Williamsport, $20,971. The itemized bids will probably be published next week.

BALTIMORE, MD.—The mayor has signed a bill appropriating $140,000 for constructing a sewer in Alluvion St.

ALLIANCE, O.—Press reports state that the state board of health has been asked to approve the plans of Alliance for a proposed intermittent filtration system of purifying the sewage of that city. Recently the state board refused to approve the plans of the city, which contemplated the emptying of the sewage into the Mahoning River, and suggested the preparation of plans for purification.

CINCINNATI, O.—Plans have been prepared and approved by the state board of health for the extension of the Bates Run, Badgley Run, Bold Face Creek, and other sewers. Plans were also prepared for extending the Crawfish Creek and one other sewer, but they were not approved for fear of the contamination of the water supply. H. J. Stanley, Cy. Engr.; Dr. Byron Stanton, Pres. State Bd. Health.

WARREN, O.—The city solicitor has recommended the construction of a main sewer in the west side.

INDIANAPOLIS, IND.—Bids are asked until April 30 for constructing 7,370 ft. of 24 to 6-in. pipe sewers in four streets and alleys. Chas. C. Brown, Cy. Engr.——It is proposed to construct an intercepting sewer for White River, estimated to cost $120,000.

PEORIA, ILL.—A large table giving the itemized bids for the West Bluff system, is not published this week for lack of space.

MILWAUKEE, WIS.—The following contracts have been awarded for constructing sewers: Becher St., James Markey, 1,124 ft. brick sewer at $4.17, 104 ft. pipe sewer at $1.75; Locust St. and Fourth St., G. E. Zimmermann, 53 ft. brick sewer at $4, 1,301 ft. pipe sewer at $1.07; Grove St., G. E. Zimmermann, 1,229 ft. pipe sewer at $1.23; Burrell St., J. Werner, 614 ft. pipe sewer at 98 cts.; Murray Ave. and Folsom Place, C. A. Mosher, 2,312 ft. brick sewer at $3.68, 261 ft. pipe sewer at $1; Locust St. and Louis Ave., P. J. Wilson, 474 ft. brick sewer at $2.69, 42 ft. pipe sewer at $1.10.

WESTPORT, MO.—Bids are asked until May 4 for constructing 10,000 ft. of 10 to 6-in. pipe sewers, as stated in our advertising columns. F. S. Robertson, Cy. Engr.

GARBAGE DISPOSAL.

ALBANY, N. Y.—A bill has passed the assembly authorizing this city to issue bonds for a garbage crematory.

ELMIRA, N. Y.—The board of health is reported as in favor of a garbage crematory.

DETROIT, MICH.—The three-year garbage contract has been awarded to the Detroit Sanitary Works, the present contractors, at $50,000 a year. The company is to pay a rebate of 80 cts. a ton on all garbage collected in excess of the amount collected in 1894, which is reported as about 15,000 tons.

STREETS AND ROADS.

BOSTON, MASS.—The following bids were received by the water board April 20 for building the new Framingham-Marlboro road to the new basin in Southboro, the work consisting of 34,700 cu. yds. earth excavation, 150 cu. yds. rock excavation, 300 cu. yds. dry rubble masonry, and 19,820 ft. of stone wall: William T. Davis, $17,253; A. Micheline & Jose Canedelia, $10,607; William H. Magee, $22,515; Newell & Snowling, $19,646; Andrew Carberry, $17,674; Charles McDermott, $16,562.

JAMAICA PLAIN, MASS.—Bids are asked until April 30 for building 1,500 ft. of streets. Address Morton & Quimby, 827-53 State St., Boston.

WORCESTER, MASS.—Bids are asked until April 29 for 12,000 sq. yds. of stone paving, 20,000 lin. ft. of curbstone, etc. L. B. Stone, St. Comr.

CRANSTON, R. I.—The Knightsville Improvement Society is discussing the question of improving the roads.

STONINGTON, CONN.—D. B. Spalding, E. E. Bradley and M. A. Pendleton have been appointed a committee to consider the advisability of macadamizing or paving the streets.

WATERBURY, CONN.—Bids are asked until May 1 for 3,350 sq. yds. of granite block paving. R. A. Cairns, Cy. Engr.

ALFRED, N. Y.—Bids are asked by the town board until May 8 for macadamizing 12,000 lin. ft. of road, as stated in our advertising columns. Engr., F. A. Dunham, Plainfield, N. J.

BROOKLYN, N. Y.—Bids are asked until May 6 for flagging portions of sidewalks; 24 contracts. A. T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—The only bids received for paving Cornwall Ave., 32 ft. wide, and Sheridan St., 30 ft. wide, with American bituminous rock, were those of the Buffalo Paving Co., at $30,310 and $12,098, respectively.

FREDONIA, N. Y.—The residents of Main St. are about to petition for the paving of that street, probably with brick.

NIAGARA FALLS, N. Y.—The board of public works will recommend to the council that the asphalt pavement on Main St. already contracted for be continued from Thomas to Niagara St., at an estimated cost of $6,250.

ROCHESTER, N. Y.—The paving of Exchange St., estimated to cost $10,500, is being considered.——The following bids have been received for paving Gibbon Ave. with asphalt, the estimated cost being $45,000: American Asphalt Co., $42,378; Rochester Vulcanite Paving Co., $43,928; Rock Asphalt Paving Co., $44,163; Warren-Scharf Asphalt Paving Co., $44,707.

POUGHKEEPSIE, N. Y.—Bids are asked until May 6 for tearing up and removing the block pavement, etc., on Market St. and repaving the street with asphalt blocks. E. P. Bogardus, Chamberlain.——It is proposed to repave a portion of Garden St.

HOBOKEN, N. J.—Bids are asked until May 8 for paving a portion of Monroe St. M. V. McDermott, Cy. Clk.——Michael Curley has been awarded the contract for constructing both divisions of the Weehawken branch of the new county road at $73,616 for the first division and $59,785 for the second.

JERSEY CITY, N. J.—Bids are asked until April 29 for 3,150 sq. yds. of stone paving, etc., in Clark St. Geo. T. Bouton, Clk. St. Comrs.

BELLEVILLE, N. J.—The citizens are considering a plan for macadamizing the streets, at an estimated cost of about $56,000. W. H. Webster, Chn. Com.

ALLENTOWN, PA.—The council has been petitioned to improve a large number of streets.

CARBONDALE, PA.—Bids are asked until May 13 for paving two streets with brick, as stated in our advertising columns. Cy. Engr., Walter Frick; Cy. Clk., T. L. McMillan.

ERIE, PA.—Bids are asked until May 6 for paving 13,600 sq. yds. with sheet asphalt, 3,351 sq. yds. with vitrified brick on 6 ins. concrete, and 9,417 sq. yds. with asphaltum block, as stated in our advertising columns. Geo. Platt, Cy. Engr.

HONESDALE, PA.—The Penn Mutual Insurance Co., of Philadelphia, has purchased $75,000 in bonds, which will be used for improving the roads of Cheltenham township.

LOCK HAVEN, PA.—Bids are asked until May 1 for brick street paving. E. P. Geary, Clk.

WASHINGTON, PA.—The council of East Washington has been petitioned to pave 2,400 lin. ft. in two streets, at an estimated cost of $11,000.

WILKES BARRE, PA.—The paving of Bear Creek boulevard to the Public square with brick is being discussed.

BALTIMORE, MD.—Bids are asked until May 1 for paving a portion of Pulaski St. A. E. Smyrk, Cy. Comr.——An ordinance appropriating $43,000 for paving Eastern Ave. with mosaic pavement has been passed.——It is proposed to pave and improve five other streets.

WASHINGTON, D. C.—Bids are asked by the district commissioners until May 3 for grading and regulating streets, as stated in our advertising columns.

NEW ORLEANS, LA.—It is proposed to pave portions of 14 streets. T. W. Campbell, Asst. Clk. Council.

CINCINNATI, O.—Bids are asked by the board of administration until April 30 for paving portions of five streets with brick.

EUCLID, O.—The question of widening Euclid Ave. to a width of 100 ft. and making it a boulevard is

INDIANAPOLIS, IND.—Bids are asked until April 30 for 14,258 sq. yds. of asphalt paving, 1,868 sq. yds. of brick paving, and 6,683 lin. ft. of curb.——Resolutions have been passed for 2,700 lin. ft. of asphalt and 1,420 lin. ft. of brick paving. Chas. C. Brown, Cy. Engr.

ST. LOUIS, MO.—Bids are asked until May 10 for paving portions of 11 streets with Telford macadam and five streets with brick. E. S. Foster, Secy. Bd. Administration.

DES MOINES, IA.—Bids are asked by the board of public works until April 30 for about 18,798 lin. ft. of cement curbing, and for about 52,000 sq. yds. of brick paving, and until May 4 for about 2,000 sq. yds. of brick and asphalt paving on 6-in. concrete foundation.

TORONTO, ONT.—Bids are asked until May 4 for supplying brick and cement for the year ending May 31, 1896. Daniel Lamb, Chn. Com.

TORONTO, ONT.—The city engineer has recommended the paving of 11 streets with brick, 15 streets with asphalt, and 12 streets with cedar blocks. C. H. Rust, Deputy Engr.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

CEMENT.—Minneapolis, Minn.—Bids are asked until April 30 for a supply of cement. Chas. F. Haney, Cy. Clk.

HARBOR IMPROVEMENTS.—Albany, N. Y.—Governor Morton has signed a bill reappropriating $87,000 for improving Black Rock harbor.

TELEPHONE FRANCHISE.—Paris, Ky.—A ten-year franchise has been granted to the Paris Telephone Co. Pres., H. A. Power.

IRON FENCE.—Napoleonville, La.—Bids are asked until May 11 for the construction of 1,030 ft. of iron fence around court yard. E. P. Munson, Chn. Com.

DREDGING.—Philadelphia, Pa.—Bids are asked until May 16 for dredging in the channel through Perrywig Bar, Delaware River. Maj. C. W. Raymond, U. S. Engr. Office.

DOCKS.—Buffalo, N. Y.—Plans have been made for a new dock 185 ft. long and 10 ft. wide at the foot of Ferry St. J. F. Schoellkopf, Merchants' Exchange Bldg., is the owner.

FLOAT STAGE.—New York, N. Y.—Bids are asked by the department of docks until April 30 for building and delivering a float stage for the boat landing at Pier A, North River.

TELEGRAPH SUPPLIES.—Brooklyn, N. Y.—Bids are asked until May 3 for furnishing telegraph materials and supplies for year 1895. L. R. Welles, Comr. Police and Excise.

PIER.—Cleveland, O.—Bids will soon be asked by Col. Jared A. Smith, U. S. Engineer Office, for a new pier upon the east side of the river, to cost nearly $40,000, according to reports.

SEA WALL.—Cambridge, Mass.—Bids are asked by the park commissioners until May 1 for building about 1,750 lin. ft. of sea wall in Charles River in East Cambridge. L. M. Hastings, Cy. Engr.

LOCK.—St. Louis, Mo.—Bids are asked until May 18 for building a portion of Lock No. 1, Osage River, Mo., as stated in our advertising columns. First Lieut. J. C. Sanford, Engr., Missouri River Comm.

TELEPHONE FRANCHISE.—Jackson, Tenn.—Bids are asked until May 15 for the privilege of erecting poles, wires, etc., and operating a telephone exchange in this city for five years. S. C. Lancaster, Cy. Engr.

RIVER IMPROVEMENT.—Lorain, O.—Bids are asked until May 6 for dredging, widening and otherwise improving Black River, as stated in our advertising columns. Engr., L. A. Fauver; Clk., J. B. Chapman.

ELECTRIC FIRE ALARM.—Cobourg, Ont.—Bids are asked until May 4 for furnishing and erecting a complete electric fire alarm system in this village, to include six boxes and about six miles of wire. D. H. Minaker, Town Clk.

TELEPHONE SYSTEM.—Emporia, Kan.—The Emporia Telephone Co. has been incorporated, with a capital stock of $8,500, to put in a telephone system at this place. Calvin Hood, L. L. Halleck, S. Strauss and T. H. Dinsmore are among the incorporators.

CEMENT, ETC.—Washington, D. C.—Bids are asked until May 3 for about 2,000 cu. yds. of river sand, 2,500 bbls. natural hydraulic cement, 1,000 bbls. Portland cement and 1,000 cu. yds. broken stone; also for a burglar-proof vault for the congressional library building. Bernard R. Green, Supt., 145 East Capitol St.

HARBOR WORK.—Seattle, Wash.—The Washington Dredging & Improvement Co. has been incorporated by Wm. F. Hays, Ellis Morrison and others, with a capital stock of $3,000,000, to fill in the tide lands in Smith's Cove, covering an area of nearly 2,400 acres. Wm. P. Humphreys, Frank Shaw, and others, of San Francisco, are said to be backing the project.

DEEP WATER.—Corpus Christi, Tex.—A press report states that a charter has been issued to the Texas Coast & Canal Co., which was organized for the purpose of deepening the Laguna Madre, a shallow body of water lying between Padre island and the mainland. This body of water is about five miles in width and about 150 miles in length.

GOVERNMENT SURVEYING.—Olympia, Wash.—Wm. P. Watson, U. S. Surveyor General, writes us as follows: Surveying work amounting to about $20,000 has just been let in the Colville Indian Reservation. This work is the subdividing into sections of about 20 townships, the exteriors of the same having been previously surveyed. Those to whom contracts have been awarded for this work are the following: Lewis D. W. Shelton, Reynolds & Pomeroy and Dimock, Pratt & Nasten. These are well-known engineers and surveyors of this state. Besides the above contracts there still remains about $10,000 of work on this reservation for which the funds are available. I hope we can let this during the present season. The delay is due to the non-completion of a certain contract, let a year or two ago, which should be finished in a month or two from this date.

CANAL WORK.—Duluth, Minn.—The "Evening Herald" states that arrangements have been completed in New York for carrying out the project of the Minnesota Canal Co., at an expenditure of about $12,000,000. It is proposed to open up 200 miles of canal and river front for navigation. The canal as surveyed is 106 miles in length, and the storage reservoirs will have a capacity of 24,000,000,000 gallons. About 15,000 acres of land will be required, and this is now being secured by condemnation proceedings. The purposes of the canal are three-fold: To secure a water supply for all purposes; for navigation and driving logs; and for developing power. The canal will have an elevation of 619 ft. above Lake Superior at the surface, and 595 ft. at the bottom of the canal. The company has agreed to furnish power at $15 per HP. a year, while the present cost is $25. Pres., Henry Curtis Spalding, C. E., of Duluth; Vice-Pres., Geo. Brownling, of Chicago; O. H. Simonds and H. H. Hanford, of Duluth, are among the directors.

LIGHTHOUSES.—Washington, D. C.—Press reports state that the appropriations of $50,000 for commencing the construction of lighthouses at Smith's Point and at Lower Cedar Point will not be available until after July 1, but the treasury department is already anticipating it and will have the designs and plans ready for proposals for the construction before the money can be utilized. About $100,000 will be necessary to complete the work. The design of the Smith's Point light contemplates a different structure from that which has been twice carried away by heavy ice floes, and to avoid possible catastrophes in the future it is proposed to build the station with a special view to its power to withstand impacts of ice fields. The main part of the structure will probably be of the screw-pile order, with a wall of riprap of stone to ward off the ice. The power of the light will be increased, and one of the new French lenses will be substituted for that which was floated away last winter. The location of the Lower Cedar Point light is to be changed to the opposite side of Potomac River from position it originally stood to secure greater range for visability both for vessels proceeding up and down the river. This station will also be after the screw-pile order, and, like the Smith's Point light, will have imported lense. Work on both will begin early in the summer, and will be completed within a year.

CONTRACT PRICES.

CEDAR BLOCK PAVING.—Minneapolis, Minn.—The following bids were received April 12 for paving six streets with cedar blocks: Canney Bros., 78 and 78½ cts. per sq. yd.; H. M. Smith, 78 cts.; M. C. Burke, 83 cts.

SEWERS.—Westfield, N. J.—F. A. Dunham, Engr., Plainfield, N. J., writes us that the contract for the trunk sewers, for which bids were received April 9, has been awarded to John Marsden, and that the contract for the laterals has not yet been awarded. The bids were as follows:

Trunk sewers, Line B.

		John Marsden.	P. H. Harrison & Sons.	Stratford & Hawkes.
18-in. sewer, under 8 ft. dp.	125 ft.	$0.70	$0.72	
18-in. " 8 to 8 " "	675 "	.75	.77	
18-in. " 8 " 10 " "	325 "	.90	.87	
18-in. " 10 " 12 " "	758 "	1.05	.95	
18-in. " 12 " 14 " "	375 "	1.15	1.23	
18-in. " 14 " 16 " "	425 "	1.35	1.37	
18-in. " 16 " 18 " "	265 "	1.55	1.81	
18-in. " 18 " 20 " "	125 "	1.80	2.00	
18-in. " 20 " 22 " "	75 "	2.10	2.48	
18-in. " 22 " 24 " "	75 "	2.45	2.37	
18-in. " 24 " 26 " "	100 "	2.80	3.10	
15-in. " under 6 " "	818 "	.50	.58	
15-in. " 6 to 8 " "	1,213 "	.65	.62	
15-in. " 8 " 10 " "	1,038 "	.75	.73	
15-in. " 10 " 12 " "	325 "	.90	.94	
15-in. " 12 " 14 " "	620 "	1.00	1.10	
12-in. " under 6 " "	700 "	.39	.44	
12-in. " 6 to 8 " "	150 "	.50	.49	
12-in. " 8 " 10 " "	375 "	.64	.65	
12-in. " 10 " 12 " "	400 "	.78	.74	
12-in. " 12 " 14 " "	100 "	.90	.89	
12-in. " 14 " 16 " "	125 "	1.10	1.03	
12-in. " 16 " 18 " "	150 "	1.50	1.50	
12-in. " 18 " 20 " "	200 "	1.50	1.62	
12-in. " 20 " 22 " "	125 "	1.75	1.81	
12-in. " 22 " 24 " "	275 "	2.20	2.51	
12-in. " 24 " 26 " "	250 "	2.50	2.52	
12-in. " 26 " 28 " "	250 "	2.95	3.24	
10-in. " under 6 " "	2,400 "	.32	.36	
10-in. " 6 to 8 " "	950 "	.38	.42	
8-in. " 6 " 8 " "	300 "	.38	.34	
Cast iron pipe:				
18-in., under 6 ft. deep....	650 "	1.75	2.00	2.00
18-in., 10 to 12 " "	12 "	1.95	2.25	2.25
15-in., under 6 " "	12 "	1.50	1.75	1.85
15-in., 6 to 8 " "	12 "	1.60	1.90	1.90
15-in., 8 " 10 " "	12 "	1.95	2.00	1.95
10-in., 10 " 12 " "	100 "	1.60	1.07	2.00
Junction manholes:				
Under 6 ft. deep.....	6...	25.00	20.00	30.00
6 to 8 " "	3...	28.00	23.00	31.00
8 " 10 " "	4...	30.00	26.00	32.00
12 " 14 " "	3...	35.00	34.00	33.00
14 " 16 " "	.....	40.00	37.00	35.00
16 " 18 " "	1...	45.00	39.00	37.00
24 " 26 " "	2...	50.00	46.00	40.00
Plain manholes:				
Under 6 ft. deep.....	8...	25.00	20.00	29.00
6 to 8 " "	7...	28.00	23.00	30.00
8 " 10 " "	4...	35.00	26.00	31.00
10 " 12 " "	1...	40.00	29.00	32.00
12 " 14 " "	1...	45.00	32.00	34.00
14 " 16 " "	1...	50.00	35.00	35.00
16 " 18 " "	.....	50.00	38.00	37.00
20 " 22 " "	1...	50.00	41.00	40.00
15-in. drop connections.....	1...	3.00	1.00	2.50
1000-gal. flushtnk "Rds-Wms"	1...	80.00	80.00	150.00
" " "Miller"...	1...	80.00	80.00	150.00
" " "V. Varken"	1...	80.00	80.00	150.00
Y-branches on 15-in. sewer..	140...	.90	.90	.90
" " " 12-in. " ..	40...	.60	.60	.85
" " " 10-in. " ..	100...	.45	.47	.45
10-in. underdrains	700...	.25	.30	.35
Total for Line B.....		$15,628	$16,153	$21,619
Total for Line A.....		$14,888	$15,173	$20,761

Lateral sewers.

		Stratford & Hawkes, Brooklyn, N. Y.	Edw. Gorman & Co., New York.	John Marsden, Utica, N. Y.	P. H. Harrison & Sons, Newark, N. J.
Sewers:					
15-in., und. r 8 ft.dp.	413 ft.	$0.85	$0.67	$0.60	$0.64
15-in. 8 to 10 " "	250 "	.95	.71	.70	.68
15-in. 10 " 12 " "	100 "	1.15	.78	.85	1.05
12-in. 8 " 10 " "	928 "	.70	.58	.60	.53
12-in. 10 " 12 " "	200 "	.75	.62	.75	.76
10-in. under 8 " "	400 "	.42	.46	.40	.39
10-in. 8 to 10 " "	488 "	.44	.50	.45	.47
10-in. 10 " 12 " "	195 "	.50	.58	.58	.63
10-in. 12 " 14 " "	180 "	.65	.67	.85	.84
8-in. under 8 " "	26,543 "	.31	.37	.32	.34
8-in. 8 to 10 " "	9,701 "	.33	.40	.45	.37
8-in. 10 " 12 " "	5,765 "	.40	.48	.65	.58
8-in. 12 " 14 " "	865 "	.50	.53	.75	.78
Cast iron pipe:					
15-in., under 8 " "	12 "	2.00	2.20	1.50	1.75
12-in. 8 to 10 " "	12 "	1.80	2.00	1.60	1.35
10-in. 8 " 10 " "	12 "	1.50	1.75	1.50	1.07
8-in. under 8 " "	72 "	1.00	1.50	.75	.80
8-in. 8 to 10 " "	24 "	1.10	1.60	.85	.90
Junction manholes:					
Under 8 ft. deep...	19...	30.30	38.00	25.00	25.00
8 to 10 " " ...	21...	30.32	40.00	28.00	28.00
10 " 12 " " ...	8...	33.00	42.00	35.00	32.00
12 " 14 " " ...	6...	33.50	46.00	40.00	35.00
Plain manholes:					
Under 8 ft. deep...	18...	20.00	34.00	25.00	23.00
8 to 10 " " ...	6...	30.00	37.00	28.00	25.00
10 " 12 " " ...	10...	30.00	41.00	30.00	30.00
12 " 14 " " ...	1...	32.00	45.00	35.00	35.00
Drop connections	39...	1.50	3.00	2.00	1.00
Lampholes	63...	7.50	7.00	6.00	4.00
150-gal. flushtanks:					
"Rhoads-Williams"	25...	70.00	70.00	55.00	55.00
"Miller"	25...	70.00	70.00	55.00	55.00
"Van Varken"	25...	70.00	70.00	55.00	55.00
500-gal. flushtanks:					
"Rhoads-Williams"	5...	100.00	125.00	60.00	65.00
"Miller"	5...	100.00	125.00	.....	.....
"Van Varken"	5...	100.00	125.00	60.00	65.00
Y-branches:					
15-in. sewers	30...	.90	.95	.90	.90
12-in. "	70...	.60	.65	.60	.60
10-in. "	58...	.50	.50	.45	.47
8-in. "	1,517...	.35	.35	.30	.33
Extension connections	276...	.50	1.40	1.00	.50
10-in. underdrains ..	900 ft.	.30	.30	.25	.30
8-in. " ..	2,815 "	.20	.25	.20	.20
6-in. " ..	1,850 "	.12	.17	.15	.18
4-in. " ..	5,750 "	.10	.11	.10	.15
3-in. " ..	1,400 "	.05	.08	.06	.10
Alternate sewers:					
18-in. 14 to 16 ft.dp.	300 "	2.00	1.40	1.35	2.00
15-in. " " " " "	500 "	1.80	1.25	1.25	1.75
15-in. 16 " 18 " "	475 "	2.00	1.35	1.50	2.00
15-in. 18 " 20 " "	125 "	2.10	1.45	1.75	2.50
10-in. 14 " 16 " "	150 "	1.50	1.10	1.15	1.25
Junction manholes:					
14 to 16 ft. deep...	3...	40.00	52.00	40.00	.....
16 " 18 " " ..	1...	42.00	57.00	42.00	.....
18 " 20 " " ..	1...	44.00	65.00	45.00	.....
Total		$31,877	$35,525	$31,866	$31,935
Actual cost		$24,234	$28,464	$26,475	$25,935

ASPHALT PAVING, ETC.—Omaha Neb.—A. C. Powers, Secy. Bd. Pub. Wks., writes us that the following bids were received by the board of public works April 12: Paving 26th St. from Woolworth Ave. to Hickory St. with Trinidad sheet asphaltum, class B, 5 years' guarantee: Barber Asphalt Paving Co., $2.19 per sq. yd.; John Grant, $2.32; Hugh Murphy, $2.27. Grading Poppleton Ave. from 3d to 4th Sts., and 4th St. from Poppleton Ave to Pierce St.: Samuel Katz, 6 cts. per cu. yd.; C. A. Jensen, 9.49 cts.; Lamoreaux Bros., 9¾ cts.; Henry Hall, 10¾ cts.; P. H. Mahoney, 11 cts. Grading alley in Block 13, Isaac & Selden's addition: Samuel Katz, 12½ cts. per cu. yd.; Henry Hall, 12¾ cts.; P. H. Mahoney, 14 cts.; Lamoreaux Bros., 19 cts. (Contracts for grading were both awarded to Samuel Katz). Curbing with Colorado sandstone, 26th St., from Woolworth Ave. to Hickory St.: Hugh Murphy, 60 cts. per lin. ft.

SEWER CASTINGS AND PIPE.—West Newton, Mass.—H. D. Woods, Cy. Engr., writes us that the following bids were received April 11 for 250 cast iron manhole frames and covers, as advertised in Engineering News:

Davis Fdry. Co., Lawrence (awarded contract)...	$4.19
Mechanics' Iron Foundry, Roxbury, Mass.....	4.46
Le Baron Foundry Co., Middleboro, Mass.....	4.46
Concord Foundry Co., Concord, N. H.....	4.09
F. B. Hawkins, 29 Broadway, New York.....	4.73
Wm. H. Harris, Hartford, Conn.....	4.87
Springfield Foundry Co., Springfield, Mass.....	4.93

Bids for 120,000 ft. vitrified sewer pipe:

	Discount.
Portland Stoneware Co., Boston (aw'd contract)..	70%
Evans & Howard, St. Louis, Mo.....	68%
Waldo Bros., 88 Water St., Boston.....	67½%
Perrin, Seamans & Co., 57 Oliver St., Boston....	67½%
W. G. Nash, 220 State St., Boston.....	67½%
Fiske, Holmes & Co., 164 Devonshire St., Boston..	67½%
D. W. Lewis, 57 Kilby St., Boston.....	67½%

ASPHALT PAVING.—Ottawa, Ont.—Robt. Surtees, Cy. Engr., has sent us the following statement of the bids received April 10 for paving two streets with asphalt: approximate quantities, 13,185 sq. yds. of asphalt paving, 13,202 lin. ft. of granite block toothing, 2,000 lin. ft. of 6×24-in. limestone curbing; contract awarded to the Canadian Granite Co., for paving with rock asphalt upon 6 ins. best Portland cement concrete, work to be guaranteed for 15 years, and 30% of cost to be retained as security:

	Asphalt, per sq. yd.	Tooth'g, per lin. ft.	Curb'g, per lin. ft.
Warren-Scharf Co., N. Y.*...	$3.20	$0.60	$1.05
Bastion & Vallignette, Montreal	3.88	0.40	0.50
Patrick Burns, Ottawa.....	[3]3.75	0.60	0.60
Sicily Asphalt Co., Montreal....	3.54	0.54	0.49
Canadian Granite Co., Ottawa.	3.60	0.45	0.45
Faquier & Co., Toronto.....	3.00	1.10	1.25
John E. Askwith, Ottawa.....	[3]3.70	0.50	0.55

* Trinidad; all others rock.
[1] Trinidad or Bermudez same price.
[2] Trinidad, $3.50.

STONE DIKES.—Cincinnati, O.—The following bids for building loose stone dikes in Ohio River were opened at Cincinnati, O., April 16, by Lieut.-Col. Amos Stickney, U. S. Engr. Office:

Bids Received at Cincinnati O., for Build ing Loose Stone Dikes in Ohio River.

Bidder.	Blennerhassetts Isld., 3,470 cu. yds.	Guyandotte Bar, 7,905 cu. yds.	Gunpowder Bar, 4,840 cu. yds.	Flint Island, 4,570 cu. yds.	Venadia Reef and Falls slough-crossing 9,174 cu. yds.	Three-Mile Island, 11,-000 cu.yds.
E. J. & H. B. Hulings, Pittsburg, Pa.	.....	.....	.....	.....	$1.17	$1.39
Joshua R. King, Parkersburg, W. Va.	$1.00	$1.15	.....	.....	.....	.....
Patterson & Shipman, Washington, D. C.	.....	1.10	$1.50	$0.95	1.10	1.10
Walter S. Ware, Cincinnati, Ohio	.....	1.85	1.95	.....	.....	.....
George F. Egan, Pittsburg, Pa.	1.89	1.89	1.89	1.89	1.89	1.89
Bedford, Weikel & Nugent, Evansville, Ind.	.....	.....	.....	.....	.9125	.9125
Samuel Monroe and Philip Kelly, Portsmouth, Ohio	1.25	1.25	1.45	1.40	1.50	1.50
Eichel, Arnold & Co., Evansville, Ind.	.....	.....	.....	.....	1.09	1.09
C. F. Crawford and P. Henson, Huntington, W. Va.	.....	2.95	.....	.....	.....	.....
Thomas H. King, Belpre, Ohio.	.89	1.75	.....	.....	.....	.....
Oliver Reed, Monaca, Pa.	.....	1.07	.....	.....	.....	.....
Josiah Thomas Hart, Marietta, Ohio	.74	.95	.....	.....	1.20	1.20
P. Halloran and F. W. Katterjohn, Jr., Paducah, Ky.	.....	.....	.....	.....	1.19	1.24
L. Cramer & Son, Parkersburg, W. Va.	.....	.....	.....	.....	1.19	1.19
William A. Kirk, Madison, Ind.	.....	.....	1.00	1.20	1.225	1.375
L. Cramer & Son, Parkersburg, W. Va.	1.10	1.14	1.35	1.50	.....	.....
J. C. Thomas, Ironton, Ohio	.....	.80	.....	.....	.....	.....
William D. Cranmond, Hawesville, Ky.	.....	.....	.....	.....	.94	.....
Gardner & Cook, Gallipolis, Ohio	.....	2.10	.....	.....	.....	.....
Henry L. Wright, Huntington, W. Va.	.....	2.74	.....	.....	.....	.....
Du Pont Improvement Co., Owensboro, Ky.	.....	.....	.....	.....	1.14	1.09

STONE ROAD.—Toledo, O.—The contract for constructing stone road No. 19, in Jerusalem township, has been awarded by the county commissioners to Garrigan Bros., this bid being reported about $2,000 lower than any other. The bids were as follows: C. H. Breyman & Co., macadamizing, $19 per lin. ft., and grading, 12½ cts. per cu. yd.; McMahon & Co., $19.50 and 19 cts.; J. & C. W. Ryan, $12.49 and 2) cts.; Murphy & Mercer, $17.60 and 12½ cts.; T. J. Kennedy, $16.50 and 20 cts.; Clark & Co., $15.35 and 13 cts.; Garrigan Bros., $11.90 and 9 cts.

VIADUCT SUBSTRUCTURE.—Cincinnati, O.—The following bids were received April 16 for constructing the substructure of viaduct on West Eighth St., over Boldface Road, as advertised in Engineering News; the bids for the superstructure are given under Bridges:

Bids for Substructure of Viaduct on West Eighth St. over Boldface Road, Cincinnati, Ohio.

Quantities.		Branham, Gest & Co.	E. C. Wendt.	J. Delaney.	P. Jonte & Co.	P. Murray & Sons.	R. Aufderheide.	T. Maloney.	Kirchner & Folk.	J. N. Dickmeier.	J. F. Molloy.	D. Flaherty.	J. Sperry.	Willen & Dorsch.	Patterson & Shipman.
Grading, masonry	2,000 cu. yds.	$0.20	$0.42	$0.10	$0.20	$0.20	$0.40	$0.20	$0.25	$0.30	$0.30	$0.30	$0.32	$0.40	$0 20
" street,	1,000 " "	.25	.55	.10	.20	.17	.35	.10	.25	.10	.20	.20	.25	.20	.20
Concrete	300 " "	2.90	3.80	2.50	3.00	2.95	3.00	.90	4.00	3.60	3.75	4.00	3.60	5.00	3.50
Masonry, rubble	1,250 " "	4.20	4.40	4.25	3.65	3.50	3.90	4.13	4.50	3.90	4.15	4.50	3.88	4.00	3.50
" dimension stone	380 " "	7.25	8.40	7.89	10.25	8.00	12.00	8.75	7.50	6.90	7.00	9.00	7.05	7.00	8.00
" coping	600 sq. ft.	.40	1.10	1.06	.90	1.10	1.25	1.25	.75	.90	.70	1.30	.93	.45	.50
Total		$9,975	$12,200	$10,242	$10,758	$9,806	$12,527	$10,105	$11,182	$10,114	$10,480	$12,182	$10,357	$10,770	$9,620

DAMS AND SHORE PROTECTIONS.—Rock Island, Ill.—The following bids were received by Lieut.-Col. A. Mackenzie, U. S. Engr. Office, April 15, for construction of dams and shore protections between Muscatine, Ia., and New Boston, Ill.:

Bidder.	Rock in place, 25,000 cu. yds.	Brush in place, 30,000 cu. yds.	Total.
A. B. Teasdale, Cassville, Wis.	$1.18	38 cts.	$40,900
A. Kirchner, Fountain City, Wis.	1.17	37 "	40,350
J. Richtman, " " "	1.40	20 "	41,000
S. J. Truax, Hastings, Minn.	1.34	60 "	51,500
Monroe & Kelly, Portsmouth, O.	1.45	70 "	57,250
A. J. Whitney, Rock Island, Ill.	1.19	38 "	41,150
James Short, St. Charles, Mo.	1.24	19 "	36,700
Patterson Bros., Keokuk, Ia.	1.12	13 "	*31,900

* Recommended for acceptance.

SEWER.—Toledo, O.—We have received a statement of the bids received for sewers in three avenues. The bidders were the same for each contract, and are all residents of Toledo. The bids for the work in Detroit Ave. were as follows:

Bidder.	2-ft. sewer.	Manholes.	Catch basins.	12-in. pipe.	*Extra sand.
Thos. Kelley	$1.15	$7.00	$32.00	$0.45	$6.00
G. H. Bodette	1.29	15.00	42.00	.42	4.50
John Degnan	1.05	7.00	45.00	.50	6.00
G. Maher	1.30	12.00	40.00	.50	5.00
P. Tansey	1.12	15.00	40.00	.50	4.00
J. H. Horan	1.20	10.00	25.00	.40	2.50
H. J. Bower	1.15	11.00	33.00	.35	4.50
F. E. Cole	1.10	7.00	35.00	.45	5.00
John Streicher	1.25	17.00	39.00	.60	5.00
Wm. J. McMahon	.85	10.00	26.00	.28	3.00
J. H. Doyle	1.27	9.00	29.00	.29	5.00
W. H. & J. J. Leith	1.55	12.00	45.00	.70	5.00

* Extra sand, in case a soft spot in the earth is found and it is needed; price is per cord.

SEWERS.—Indianapolis, Ind.—Bids were received April 9 for local sewer in Vermont St. and intersecting streets and alleys having a total length of 4,388 ft., made up of 315 ft. of 26 × 39-in. 2-ring brick sewer, 415 ft. of 22 × 33-in. 1-ring brick sewer, and 470 ft. 18-in. pipe, 250 ft. of 15-in., 1,400 ft. of 12-in., 853 ft. of 10-in., 625 ft. of 8-in., 1,695 ft. of 6-in. house connections, 14 catch basins, 18 manholes, 6 lamholes, 1 flush tank. The bids were: Wm. Bossert, $1.70 per lin. ft. of completed sewer; Fulmer-Seibert Co., $1.47; Conduitt & De Ruiter Co., $1.45; Mansfield & Allen, $1.37; L. E. Haag, $1.37; C. V. Mercer, $1.34; Dan Foley, $1.34; Sheehan Bros., $1.26; Gansberg & Roney, $1.25; H. H. Fletcher, $1.25 (awarded contract). Bids were also received for a local sewer in the alley south of North St. and neighboring streets and alleys, having a total length of 4,221 ft., made up as follows: 310 ft. of 28 × 42-in. 2-ring brick sewer, 421 ft. of 24 × 36-in. 2-ring brick, 225 ft. of 20 × 30-in. 1-ring brick, and 564 ft. 18-in. pipe, 1,426 ft. 15-in., 260 ft. 12-in., 915 ft. 10-in., 50 ft. 8-in., 50 ft. 6-in., 1,341 ft. 6-in. house connections, 15 catch basins, 18 manholes, 3 lampholes, 1 flush tank and 15 additional Y-branches. The bids were: Wm. Bossert, $2.12; Fulmer-Seibert Co., $1.71; Conduitt & De Ruiter Co., $1.75; Mansfield & Allen, $1.57; L. E. Haag, $1.89; Gansberg & Roney, $1.65; H. H. Fletcher, $1.47; Sheehan Bros., $1.46 (awarded contract).

LAYING WATER PIPE.—Milwaukee, Wis.—Contracts for laying all the water pipe in the city (probably about 25 miles) the coming season have been awarded as follows: John J. Crilley, 16-in., at 44 cts. per ft.; Wm. Forrestal, 12-in., at 34 cts. per ft.; 8-in., 24 cts.; 6-in., 18½ cts. It is stated that the prices last year were 40⅝, 41⅞, 29⅞ and 23⅝ cts. per ft., respectively, for 16, 12, 8 and 6-in. pipe.

DREDGING.—Portland, Me.—Maj. D. P. Heap, U. S. Engineer Office, received the following bids April 15 for dredging: In Harrisseckit River, Me., 40,000 cu. yds., Chas. H. Souther, Boston, Mass., at 24 cts. per cu. yd.; in Bellamy River, N. H., 70,000 cu. yds., Columbian Dredging Co., East Boston, Mass., 23 cts., and A. B. Martin, Boston, Mass., 27 cts.

WATER-WORKS.—Lyndonville, Vt.—A. D. Paige, Secy. Com., writes us that the contract for constructing a complete gravity system of water-works, as advertised in Engineering News, has been awarded to Flood & Sherrill, the bids being as follows; Engr., John W. Burke, 45 Broadway, New York:

Bids Received at Lyndonville, Vt., April 10, 1895, for Constructing Water-Works.

		N. E. Public Works Co., Boston, Mass.	Flood & Sherrill, Sandy Hill, N. Y.	Gennaro, Long & Lattie, South Braintree, Mass.	E. Gustine & Son, Keene, N. H.	Seymour & Banker, Gloversville, N. Y.	Loelen A. Taylor Boston, Mass.	Chas. L. Woodbury, Burlington, Vt.	F. R. Page & Co., Boston, Mass.	P. L. Barker & Co., Waterbury, Conn.	A. F. Nims, Elkhart, Ind.	M. D. Speer, Newport, R. I.
Earth excavation	14,000 cu. yds.	$0.27	$0.30	$0.25	$0.28	$0.40	$0.31	$0.29¼	$0.20	$0.22	$0.17	$0.65
Loose rock excavation	100 " "	4.00	.50	.60	2.25	1.50	.50	1.25	.25	1.00	.25	2.50
Solid rock excavation	300 " "	4.00	.50	2.00	4.50	2.00	3.00	2.95	.90	4.00	3.00	6.00
Embankment, pipe line	3,500 " "	.20	.15	.22	.20	.25	.25	.29¼	.19	.28	.16	.50
Rubble masonry	250 " "	16.00	7.00	8.00	8.00	7.00	7.00	7.75	8.15	10.00	4.50	6.00
Cut-stone masonry	10 " "	30.00	20.00	18.00	30.00	40.00	25.00	30.00	20.00	30.00	17.00	30.00
Concrete	5 " "	10.00	9.00	6.00	7.00	10.00	10.00	6.75	6.50	12.00	7.00	20.00
Paving	100 sq. yds.	4.00	2.75	2.50	2.25	2.00	2.00	3.25	6.00	3.00	1.00	3.00
Gate house		510.00	350.00	600.00	350.00	325.00	350.00	424.80	250.00	550.00	425.00	600.00
14-in. pipe	100 lin. ft.	1.40	1.15	1.25	1.40	1.05	1.35	1.27	1.12	1.75	1.40	1.30
10-in. light	5,000 " "	1.00	.66	.60	.75	.65	.67	.75	.63	.89	.69	.70
10-in. medium	15,900 " "	1.00	.74	.66	.82	.68	.72	.75	.69	.85	.74	.75
10-in. heavy	1,863 " "	1.00	.76	.71	.80	.75	.77	.75	.74	.95	.81	.80
8-in. "	2,400 " "	.77	.55	.53	.65	.60	.60	.61	.57	.75	.59	.55
6-in. "	5,600 " "	.55	.49	.38	.45	.45	.43	.43	.41	.60	.45	.43
4-in. "	7,200 " "	.42	.26	.24	.29	.30	.30	.27½	.29	.35	.31	.30
Specials, in place	10,000 lbs.	.....	.03	.02½	.02¾	.02¼	.02½	.02¾	.02¾	.02½	.02½	.03
14-in. stop valves, in place	2	43.00	52.00	52.00	50.00	45.00	50.00	45.00	52.50	50.00	39.00	50.00
10-in. " "	5	25.00	23.00	24.50	25.00	25.00	28.00	24.00	25.50	28.00	21.00	30.00
8-in. " "	1	18.00	16.00	17.00	17.50	20.00	19.00	17.50	19.75	25.00	15.75	20.00
6-in. " "	13	12.00	11.00	12.00	11.75	15.00	13.00	12.25	13.90	11.75	10.65	14.50
4-in. " "	9	7.00	7.00	7.50	7.25	8.00	8.00	7.25	8.50	8.00	7.00	10.00
Air valves in place	4	10.00	15.00	12.00	11.00	8.00	10.00	15.00	2.50	11.00	3.50	5.00
Hydrants, 4-in., dble. nos	32	25.00	24.00	4.50	26.00	25.00	27.00	24.50	22.50	25.00	23.00	26.00
Total		$43,483	$31,186	$20 608	$35,451	$33,165	$32,795	$33,735	$29,971	$37,794	$30,153	$40,334

SEWERS.—Schenectady, N. Y.—A contract for laying 1,400 ft. of 20-in. vitrified pipe surface water sewer on State St. has been awarded to Jas. Divine, of Schenectady, at 87 cts. per ft.

DREDGING.—Cleveland, O.—The following bids were received April 17 for city dredging for five years from April 1, 1895:

		W. E. Rooney, Toledo, O.	Cleveland D'd'g. Co., Cleveland, O.	The L. P. & J. A. Smith Co., Cleveland, O.	O. Lockerbie, Detroit, Mich.
Excavation:					
Dumped in lake	671,500 cu.yds.	$0.12	$0.125	$0.14	$0.15
Dep. on banks	100,000 " "	.12	.125	.14	.135
Logging	800 hours.	8.00	7.80	8.00	7.50
Total		$98,980		$114,410	
Total			$102,677		$119,225

The contract has been awarded to William E. Rooney At a previous opening of bids the lowest was Geo. Lockerbie, at 10 cts. per cu. yd., as stated in these columns, but he refused to accept the contract, and is now under prosecution to forfeit bond of $5,000 for same.

INDUSTRIAL NOTES.

LEWIS M. LOSS, contractor, of Chicago, Ill., is reported to have a contract for a large irrigation ditch in Mexico.

THE BARNEY & SMITH CAR CO., of Dayton, O., has an order for 500 hopper-bottom coal cars for the Pennsylvania R. R.

POULTERER & CO., of Philadelphia, Pa., have shipped three small locomotives to rock phosphate companies in Florida.

THE BARR PUMPING ENGINE CO., of Philadelphia, Pa., will build a brick shop 57 × 97 ft. at Germantown Junction, Pa.

THE SOUTH BALTIMORE CAR WORKS, of Baltimore, Md., has an order for 300 refrigerator cars for the Baltimore & Ohio R. R.

THE MICHIGAN-PENINSULAR CAR CO., of Detroit, Mich., has an order for 100 hopper-bottom gondola coal cars for the Cleveland, Lorain & Wheeling R. R.

THE NATIONAL WATER TUBE BOILER CO., of New Brunswick, N. J., has an order for boilers aggregating 7,500 HP. for the Johnson Co.'s steel plant at Lorain, O.

WM. KENNEDY & SONS, of Owen Sound, Ont., Canada, have an order for 18 water wheels, aggregating 6,000 HP., for a large wood pulp mill at Sault Ste. Marie, Ont.

THE MICHIGAN BRASS & IRON WORKS, Chicago, Ill., informs us that the Maywood, Ill., Board of Trustees has adopted the Michigan gate hydrant, and 412 hydrants will be required.

GEORGE O. TENNEY, contractor, of Chattanooga, Tenn., has a contract for a large granite masonry dam, to be built for the Clifton Mfg. Co. This makes the third mill the company owns.

BALTIMORE DREDGING CO., of Baltimore, Md., has been awarded the following government contracts: La Trappe River, 40,000 cu. yds.; Cambridge Harbor, 45,000 cu. yds.; Nanticoke River, 43,000 cu. yds.; Manokin River, 34,000 cu. yds.; Wicomico River, 30,000 cu. yds.; Warwick River, 17,000 cu. yds.; Choptank River, 17,000 cu. yds.; Chester River, 8,000 cu. yds.

THE LINDEN STEEL CO., of Pittsburg, Pa., has started up one of its open-hearth furnaces, and is also manufacturing steel plates for the running boards of locomotives for several railways.

THE EDDY VALVE CO., of Waterford, N. Y., has elected the following persons as directors: Pres., John Knickerbacker; Vice-Pres., H. C. Rogers; Secy. and Treas., Thomas A. Knickerbacker.

THE PIERCE CONSTRUCTION CO., of 53 State St., Boston, Mass., has the contract for building the electric railway from Stoneham, Mass., to Reading, Mass. Cars are to be running by May 30.

CRAGE & TENCH, contractors, of Buffalo, N. Y., who have the contract for the Niagara Falls & Lewiston electric railway, have established an office in the Young Hotel Building, at Niagara Falls, N. Y.

THE LEWIS & FOWLER MFG. CO., of Brooklyn, N. Y., which is in the hands of a receiver, may be consolidated with the Lewis & Fowler Girder Rail Co., and carry on the manufacture of car appliances.

THE HERCULES FLOAT WORKS, 54 Taylor St., Springfield, Mass., has undertaken the manufacture of seamless copper floats for steam and hydraulic apparatus. Pres., H. S. Anderson; Man., F. Engelhardt.

THE WELDLESS STEEL TUBE CO., of Pittsburg, Pa., has been incorporated, with a capital stock of $250,000, to operate under the patents of Geo. H. Everson, of Pittsburg, for making weldless tubes and coating them with copper.

THE WALKER MFG. CO., of Cleveland, O., has orders for three direct-coupled generators of 200 KW. for the St. Charles St. Ry. Co., of New Orleans, La.; and two belted generators of 125 KW. for the Norfolk & Ocean View Ry. Co., of Norfolk, Va.

THE BROWN HOISTING & CONVEYING MACHINE CO., of Cleveland, O., is putting in a 25-ton electric traveling crane of 113 ft. span at one of the water-works pumping station at Pittsburg, Pa., for removing the old and erecting the new engines.

THE BERLIN BRIDGE CO., of East Berlin, Conn., is building an extension to the casting shop of the Waterbury Brass Co., at Waterbury, Conn. The company also designed the new foundry which the Jackson & Woodin Mfg. Co. is now building at Berwick, Pa.

THE GLOBE IRON WORKS, of Cleveland, O., has an order for a steel steam canal boat and five steel canal barges for the Steel Canal Barge Co., which will run its fleet from Lake Erie ports through the Erie Canal. All the boats are to be 98 ft. long, 17¾ ft. beam and 10 ft. deep.

THE COATES MFG. CO., of Columbus, O., manufacturing a recuperative oil and gas burner, writes us that the statement that appeared in our issue of April 18, to the effect that it has a contract to equip the engines of the St. Louis Merchants' Terminal Bridge Co., was incorrect.

THE LOVE ELECTRIC TRACTION CO. has moved its main office from Washington, D. C., to New York city, and will build a road on its conduit system in this city. The system has been described in our columns. Ch. Engr., Geo. W. McNulty, M. Am. Soc. C. E., 45 Broadway, New York.

THE KALAMAZOO RAILROAD VELOCIPEDE & CAR CO., of Kalamazoo, Mich., has recently shipped a mixed car-load of hand and velocipede cars to Guatemala. It will also make shipments of velocipede cars to Zurich, Switzerland, and Moscow, Russia, and is shipping one of its improved steam inspection cars to the Choctaw, Oklahoma & Gulf R. R. It reports a fairly good demand for its specialties, which include steel surface cattle guards, and hand, push and inspection cars of all kinds.

THE HAMILTON BRIDGE WORKS (Ld.), of Hamilton, Ont., Canada, is the reorganized name of the Hamilton Bridge Co. The company will undertake the manufacture of railway and highway bridges, boilers and tanks, water towers, and structural ironwork, and has a shipyard for building ships and barges of steel or iron. Ch. Engr., J. W. Schaub, M. Am. Soc. C. E.

THE KELLOGG IRON WORKS, of Buffalo, N. Y., is to be sold by Walter J. Shepard, the assignee. The plant covers a lot 272 × 335 ft., with one of the longer sides fronting on the belt line of the New York Central R. R. The main building is U-shaped, 220 × 200 ft., and 50 ft. wide, of steel construction, with board sides. There are also an engine and boiler house 36 × 36 ft., office building, 40 × 30 ft., and barn, 36 × 20 ft.

THE CAMPBELL & HOUSE COMBINATION FREIGHT & HUMANE STOCK CAR CO., of Baltimore, Md., has been organized, with a capital stock of $500,000, to manufacture the combination or convertible cars for freight and stock service, which were noted in our issue of April 18, and which we describe and illustrate in another column of this issue. Pres., Edwin Warfield; Vice-Pres., R. B. Campbell, B. & O. R. R.; Secy. and Treas., Frank M. Hildebrandt.

THE MEMPHIS CAR & FOUNDRY CO., of Memphis, Tenn., has built for C. W. Goyer & Co., of Memphis, Tenn., a number of tank cars for carrying molasses. The cars have a capacity of 5,000 gallons, equivalent to a load of 60,000 lbs. Steam pipes are laid in the bottom of the tank, so as to heat the molasses and make it run more freely when the tank is being emptied, and a pump is provided by which the tank can be emptied in 15 minutes.

THE BRASS & IRON WORKS CO., of Fostoria, O., writes us that the U. S. Court of Appeals has reversed the decree and dissolved the injunction which the U. S. Circuit Court gave Curtis & Curtis, of Bridgeport, Conn., against the Wells Machine Works, of Fostoria, O., for alleged infringement of pipe threading machines, and sustained all the claims of the defendant. T. C. & F. E. Wells have licensed the Brass & Iron Works Co. to manufacture the machines in question, now greatly improved, together with their line of special pipe mill machines, nipple and jobbing machines, automatic nipple machines and bolt threading and nut tapping machines.

NEW COMPANIES.—Reno Inclined Elevator Co., Plainfield, N. J.; $100,000, all paid in; Albert H. Atterbury, Plainfield, N. J.; Jesse W. Reno and Boudinot Keith, New York, N. Y.

Jefferson Iron Co., Jefferson, Tex.; $100,000; W. B. Ward and L. S. Schluter.

Royal Tennessee Marble Co., Pittsburg, Pa.; $5,000, with $500 paid in; Treas., George W. Hackett.

Pittsburg Mineral Screen Co., Pittsburg, Pa.; $5,000, with $500 paid in; Treas., George W. Haskett.

Keystone Forging Co., Northumberland, Pa.; $30,000, with $3,000 paid in; Treas., Gilbert R. Van Alen.

Sewer Pipe Supply Co., Buffalo, N. Y.; $1,500; Alfred Lyth, Nathaniel C. Barnum and W. F. Dunspaugh.

Automatic Burner Air Pressure Co., Chicago, Ill.; $25,000; Peter Keller, R. N. Rudolph and O. Ulrichs.

Strahan Architectural Supply Co., Chicago, Ill.; $20,000; S. E. Strahan, F. E. Sargent and Daniel Samuels.

National Asphalt Paving Co., St. Louis, Mo.; $2,000, with $1,000 paid in; E. G. Gereke, Lee Lamoureux and E. E. Scharf.

D. R. & H. Automatic Mfg. Co., of New York, N. Y.; $300,000; David M. Demarest, Albert N. Romaine and E. C. Howell.

Hyde Park Foundry & Machine Co., Hyde Park, Pa.; $20,000, with $2,000 paid in; Treas., George F. Shull, Leechburg, Pa.

Alberton Gold Mining Co., Duluth, Minn.; $800,000, with $25,000 paid in; J. O. Flaherty, James Goodwillie and C. A. Moore.

Dustless Railway Coach Co., East St. Louis, Ill.; $1,000,000; Thomas F. Furlong, Thomas O. Dix and Christopher Branch.

American Equipment Co., Kansas City, Kan.; $1,000,000; locomotives and cars; K. T. Bastman, J. V. Brintrand and W. T. Hurt.

Philadelphia Public Works Co., Philadelphia, Pa.; $1,000,000, with $500 paid in; John M. Sharp, Thomas Dickson and Jacob Reis.

Troy Coal Tar & Chemical Co., Troy, N. Y.; for roofing, sheathing felt and paper, etc.; W. H. Squarey, C. W. Bilfinger and J. Cayrd.

American Artificial Stone Pavement & Construction Co., Philadelphia, Pa.; $1,000,000, with $500 paid in; John W. Ellis, Frank Roeder and Jacob Plant.

Smedley Paving Co., Philadelphia, Pa.; $10,000, with $1,000 paid in; cement and asphalt paving; Treas., Horace Stoker, Holmesburg, Philadelphia, Pa.

San Antonio Sewer Pipe & Mfg. Co., San Antonio, Tex.; $100,000; George W. Russ and N. Mackey, of San Antonio, Tex.; Aaron Frend, of Indianapolis, Ind.

New England Anthracite Coal Co., New York, N. Y.; $300,000; Frank W. Coolbaugh and Frederick S. Pearson, of New York, N. Y.; Winthrop Thayer, of Boston, Mass.

Thomas Berger & Sons Co., Douglas, W. Va.; $500,000, with $30,000 paid in; lumber dealing, logging railways, etc.; Thos. Berger and E. D. Berger, Davis, W. Va.

Acme Coupler Co., Ewing, N. J.; $300,000, with $1,000 paid in; car couplers; W. L. Hoffecker and A. D. Keys, Elizabeth, N. J.; James B. Dayton, Matawan, N. J.

Rockland Telephone & Telegraph Co., Rockland, N. Y.; $8,000; Wm. R. Thompson and Frank L. Cosgrove, of Suffern, N. Y.; A. A. Demarest, of West Nyack, N. Y.

Universal Industrial Power Co., Newark, N. Y.; $1,000,000, with $15,000 paid in; machinery, etc.; Joseph Dughi, Cesare Basilea and Luigi Ottolma, all of Newark, N. J.

Northern Paving & Construction Co., Jersey City, N. J.; $25,000, with $15,000 paid in; Albert C. Wall, Orange, N. J.; W. R. Warren and Henry R. Bradbury, New York, N. Y.

New Jersey Contracting & Developing Co., Passaic, N. J.; $10,000, with $9,000 paid in; Fred W. Wentworth, James G. Blauvelt and Schuyler C. McCarthy, all of Paterson, N. J.

Gas Saving Co., Jersey City, N. J.; $50,000, with $1,000 paid in; gas regulators; Charles F. Leavenworth, Washington, D. C.; Wm. A. Bantz, Baltimore, Md., and Joseph N. Robinson, Red Bank, N. J.

GRADING, CURBING AND PAVING.

SEALED PROPOSALS.

CITY ENGINEER'S OFFICE,
ERIE, Pa., April 19, 1895.

Sealed proposals will be received at this office until 7:30 o'clock p. m. on Monday, May 6, 1895, for the grading, curbing and paving with vitrified brick of Ninth street, from the west line of Cherry street to the east line of Liberty street.

Plans and specifications can be seen at this office, where blank proposals may be procured.

A certified check or certificate of deposit payable to the order of the City Treasurer of the city of Erie, or cash in the sum of three hundred dollars ($300) must accompany each proposal, conditioned upon a contract being made if awarded by the Councils.

Bids to be opened and contract awarded by the joint session of Councils May 6, at 7:30 p. m.

The Councils reserve the right to reject any or all bids; also to waive defects in form.

GEORGE PLATT,
17-2t City Engineer.

SEALED PROPOSALS.

CITY ENGINEER'S OFFICE,
ERIE, Pa., April 19, 1895.

Sealed proposals will be received at this office until 7:30 o'clock p. m. on Monday, May 6, 1895, for the grading, curbing and paving with sheet asphalt of Chestnut street from the south line of Fourth street to the north line of Eighth street.

Plans and specifications can be seen at this office, where blank proposals may be procured.

A certified check or certificate of deposit payable to the order of the City Treasurer of the City of Erie, or cash in the sum of three hundred dollars ($300) must accompany each proposal, conditioned upon a contract being made if awarded by the Councils.

Bids to be opened and contract awarded by the joint session of Councils May 6, at 7:30 p. m.

The Councils reserve the right to reject any or all bids; also to waive defects in form.

GEORGE PLATT,
17-2t City Engineer.

SEALED PROPOSALS.

CITY ENGINEER'S OFFICE,
ERIE, Pa., April 19, 1895.

Sealed proposals will be received at this office until 7:30 o'clock p. m., on Monday, May 6, 1895, for the grading, curbing and paving with sheet asphalt, of Walnut street from the south line of Fourth street to the north line of Eighth street.

Plans and specifications can be seen at this office, where blank proposals may be procured.

A certified check or certificate of deposit payable to the order of the City Treasurer of the City of Erie, or cash in the sum of three hundred dollars ($300) must accompany each proposal, conditioned upon a contract being made if awarded by the Councils.

Bids to be opened and contract awarded by the joint session of Councils, May 6, at 7:30 p. m.

The Councils reserve the right to reject any or all bids; also to waive defects in form.

GEORGE PLATT,
17-2t City Engineer.

SEALED PROPOSALS.

CITY ENGINEER'S OFFICE,
ERIE, Pa., April 19, 1895.

Sealed proposals will be received at this office until 7:30 o'clock p. m. on Monday, May 6, 1895, for the grading, curbing and paving with asphaltum block of Sassafras street from the south line of Eighteenth street to the north line of Twenty-sixth street.

Plans and specifications can be seen at this office, where blank proposals may be procured.

A certified check or certificate of deposit payable to the order of the City Treasurer of the City of Erie, or cash in the sum of four hundred dollars ($400) must accompany each proposal, conditioned upon a contract being made if awarded by the Councils.

Bids to be opened and contract awarded by the joint session of the Councils, May 6, at 7:30 p. m.

The Councils reserve the right to reject any or all bids; also to waive defects in form.

GEORGE PLATT,
17-2t City Engineer.

SEALED PROPOSALS.

CITY ENGINEER'S OFFICE,
ERIE, Pa., April 19, 1895.

Sealed proposals will be received at this office until 7:30 o'clock p. m. on Monday, May 6, 1895, for the grading, curbing and paving with genuine Trinidad Lake sheet asphalt of Chestnut street from the south line of Eighth street to the north line of Twelfth street.

Plans and specifications can be seen at this office, where blank proposals may be procured.

A certified check or certificate of deposit payable to the order of the City Treasurer of the City of Erie, or cash in the sum of three hundred dollars ($300) must accompany each proposal, conditioned upon a contract being made if awarded by the Councils.

Bids to be opened and contract awarded by the joint session of Councils May 6, at 7:30 p. m.

The Councils reserve the right to reject any or all bids; also to waive defects in form.

GEORGE PLATT,
17-2t City Engineer.

PROPOSALS FOR CAST IRON PIPE AND SPECIAL CASTINGS.

Sealed proposals will be received at the office of the Syracuse Water Board, City Hall, Syracuse, N. Y., until 2:30 o'clock p. m. of the 6th day of May, 1895, for furnishing and delivering, on board platform railway cars, in the City of Syracuse, about 9,250 tons of straight pipe, and about 645,000 lbs. of special castings. The manufacture and delivery of the pipes will be divided into seven separate parcels or sections, as follows:

Section A.

1,310 tons of 36-inch pipe.
350 " 30 "
140,000 lbs. of specials of 36 and 30-inch pipe.

Section B.

50 tons of 24-inch pipe.
1,200 " 20 "
1,000 " 16 "
140,000 lbs. of specials of 24, 20, and 16-inch pipe.

Section C.

150 tons of 12-inch pipe.
220 " 10 "
690 " 8 "
260 " 6 "
90,000 lbs. of specials of 12, 10, 8, and 6-inch pipe.

Section D.

60 tons of 12-inch pipe.
380 " 10 "
350 " 8 "
150 " 6 "
65,000 lbs. of specials of 12, 10, 8, and 6-inch pipe.

Section E.

180 tons of 12-inch pipe.
220 " 10 "
670 " 8 "
180 " 6 "
90,000 lbs. of specials of 12, 10, 8 and 6-inch pipe.

Section F.

470 tons of 12-inch pipe.
330 " 10 "
60,000 lbs. of specials of 12 and 10-inch pipe.

Section G.

660 tons of 8 inch pipe.
320 " 6 "
60,000 lbs. of specials of 8 and 6-inch pipe.

The Syracuse Water Board reserve the right to award the work to seven different parties, or to award two, three or more sections to one party, as they may deem best for the interests of the city of Syracuse. The delivery of each section must begin on or before June 1, 1895. Section A must be completed on or before Aug. 1, 1895, section B must be completed on or before Sept. 1, 1895; sections C, D, E, F and G must be completed on or before Oct. 1, 1895. Blank forms of contract, specifications, bonds, conditions and proposals can be obtained at the Engineer's office of the Syracuse Water Board, in said city, on application. Proposals should be endorsed, "Tenders for Water Pipe," and be addressed to James B. Brooks, Secretary, Syracuse Water Board, Syracuse, N. Y.

The Syracuse Water Board reserve the right to reject any or all bids.

J. B. BROOKS, Secretary.
W. R. HILL, Chief Engineer.

SYRACUSE, N. Y., April 19, 1895. 17-1t

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